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Final Report
NASA Grant NAGW-5017
What is Space Weather? -- A Workshop for Science Writers

C. Robert Clauer, Principal Investigator

This project sponsored the organization and hosting of a workshop for science writers to learn about the physical nature of and impact of space weather. Several of the nation's foremost space researchers who have particularly strong skills in articulating information about space weather and its potential impact on society participated in the workshop. These individuals include: Dan Baker, Howard Singer, John Kappenman, Joe Gurman, Jim Green, Janet Kozyra, Tim Killeen, Ray Roble, Lou Lanzerotti. The workshop was held in Ann Arbor on Feb. 23, 1966 and the agenda for the meeting is attached. Pat Reiff had planned to attend but was unable so her presentation was canceled and Tim Killeen made a presentation in her place. Mario Acuna was unable to attend and Jim Green attended in his place. Ray Roble attended and while he did not make a formal presentation he did participate in the question and answer periods and in the discussion.

The news and information service of the University of Michigan assisted in preparing a mailing list of the nation's major science writers and undertook the mailing of workshop information. About 50 news writers were notified about the workshop and 7 reporters attended. The attending reporters were: Jon Van from the Chicago Tribune, Madeline Nash from Time Magazine, Matt Crenson from the Dallas Morning News, Nancy Ross Flanigan an independent writer, Karl Bates from the Detroit Free Press, Dave Thomas from the American Geophysical Union, and Steve Marin from Goddard Space Flight Center. A number of other reporters contacted us regarding the workshop indicating an interest in the subject and inquiring about the possibility of receiving material from the workshop.

The workshop was characterized by short presentations followed by considerable discussion and time for questions and answers. This format seemed to work well. The late afternoon capstone to the workshop was a public lecture as part of the Space Physics Laboratory Colloquium Series, presented by Dr. Louis Lanzerotti titled "How does the Dynamic Space Environment Affect our Technologies in Space and on the Ground."

The workshop presentations and discussion as well as the Lanzerotti colloquium were video taped. The tapes were edited to include several of the best presentations. Sixty tapes were produced. A copy of the tape and other workshop materials (copies of presentations and the Guide to Space Weather Information via the WWW developed by Janet Kozyra) were distributed to workshop participants as well as others who requested more information. The availability of the tapes was advertised to the entire mailing list and about seven additional people requested to receive a copy. A copy of the tape is included in this final report. We have also compiled a list of space scientists throughout the country and in other countries who responded to us volunteering to be contact points for media questions. A copy of this list is enclosed as well and has been extensively distributed to science writers.

We know of several articles that resulted from this workshop. Articles appeared in the Dallas Morning News, the Chicago Tribune, and in Time Magazine.

Enclosures:
Workshop Agenda
Video Tape of selected workshop presentations and Lanzerotti Colloquium
List of Space Weather experts willing to interact with the media

“What is Space Weather”

A Workshop for Science Writers

Space Physics Research Laboratory

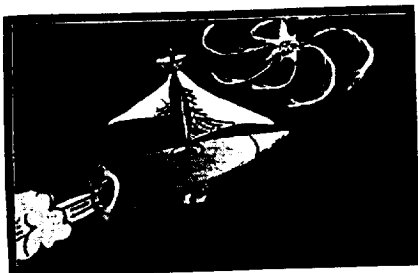
The University of Michigan

Ann Arbor, Michigan

February 23, 1996

Janet Kosyra (SPRL)

**Mining Information Related to Space Weather
Using the World Wide Web**



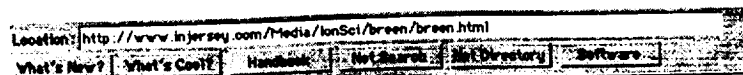
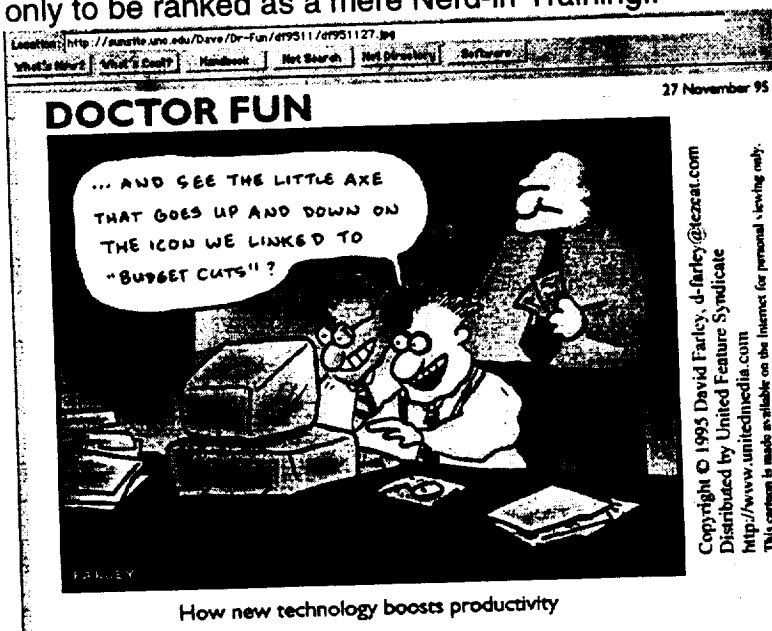
Pocket Guide to Space Weather Sites on the World Wide Web

Introduction

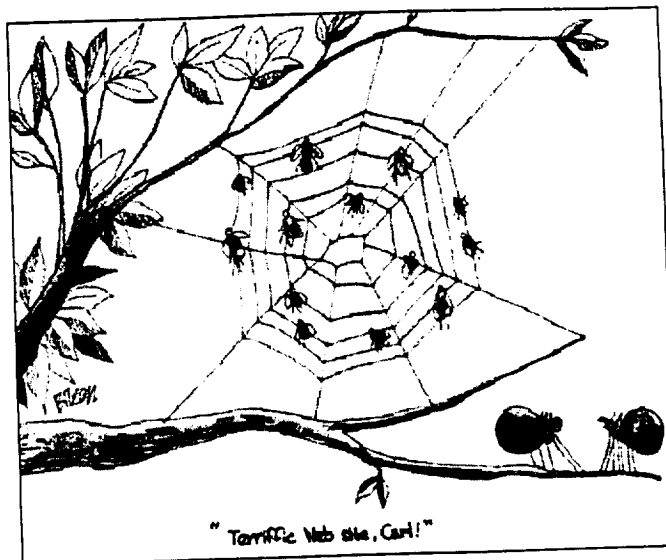
The web is rapidly coming into its own as a vehicle for accessing the nation's vast storehouse of space science information. New planetary and earth-orbiting satellite missions all have a web presence. Many national observatories, satellites, and forecasting facilities allow access to their near-realtime data streams through web interfaces. NASA's archives of photographs and spacecraft databases are open to web users to browse.

The Purpose of this Guide

There are some fascinating sites out there, if you take the time to travel the web's highways and byways. Unfortunately, this can be a time consuming exercise with many detours along the way. During preparation of this guide in the wee hours of the morning (when web traffic is lightest), I was enticed to review the entire cartoon archives of Doctor Fun. Then expended considerable time and energy making my way through the web's Nerd test - only to be ranked as a mere Nerd-in-Training..



A TILTED VIEW by Steve Breen

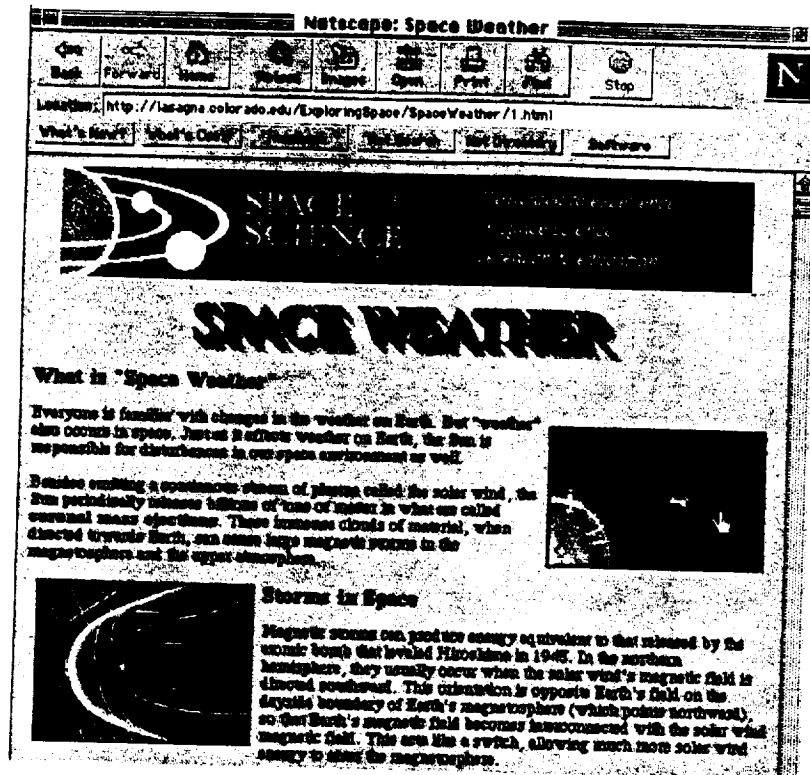


It is certainly true that the main strength of the web is the variety and quantity of information it houses. To navigate in this environment, it is sometimes helpful to have a roadmap to identify interesting sites and streamline your entry. With this purpose in mind, we spent some time visiting space weather and space physics web sites all over the world to identify some of the most visually appealing and user friendly ones among them. Within this pocket guide, we try to describe the special features of these select web sites as well as to provide information on sites which contain hot links to more complete lists of space physics related sites.

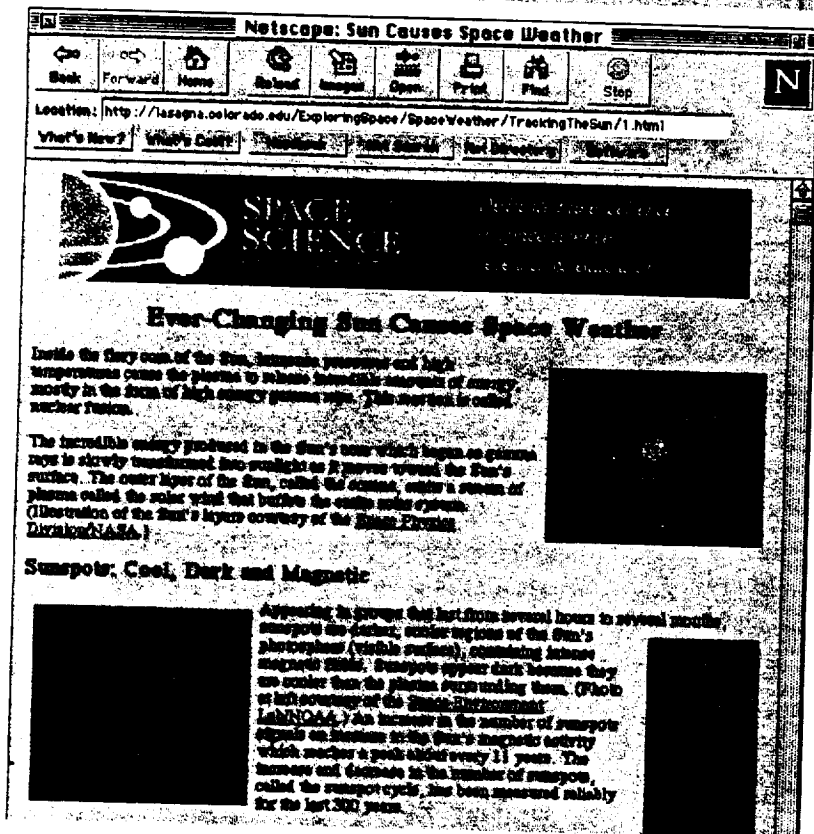
A Virtual Space Weather Library

The world wide web is a browser's paradise of on-line tours, books and multi-media exhibits related to space weather and space physics. This section contains a selection of some of the best and most complete sites.

Concise and visually-appealing tours of space weather and related topics from the Space Science Institute.



<http://lasagna.colorado.edu/ExploringSpace/SpaceWeather/1.html>




<http://lasagna.colorado.edu/ExploringSpace/TrackingTheSun/1.html>

Netscape: Today's Space Weather

Back Forward Home Reload Images Open Print Find Stop

Location: <http://lasagna.colorado.edu/ExploringSpace/SpaceWeather/WeatherReport/1.html>

What's New? What's Cool? Handbook Net Search Net Directory Software




SPACE SCIENCE INSTITUTE


Dedicated to excellence in space science research & education

Today's Space Weather


The face of the turbulent Sun, as seen here in Hydrogen-alpha wave-lengths, is far more violent than most people suppose. Hydrogen-alpha is an absorption line of neutral hydrogen in the red part of the visible spectrum. It is used to characterize solar flares, filaments, prominences, and the fine structure of active regions.




Space weather forecasts and alerts are issued by the Space Environment Services Center (SESC), part of the Space Environment Laboratory (SEL/NOAA) located in Boulder, Colorado. (Photo courtesy of SEL/NOAA.)



The SESC receives space weather data from many different satellites and ground-based stations around the world. Forecasters track sunspots, map coronal holes and provide a detailed description of all active regions visible on the solar disk. (Illustration courtesy of SEL/NOAA.)



Sunspot Groups, like those seen as dark areas in visible-light images of the Sun, are also responsible for X-ray emissions as shown here. These are active regions where hot, dense plasmas are energized. They are also associated with regions of oppositely directed magnetic fields.



X-ray flares are classified as C (low intensity), M (moderate intensity), and X (high intensity). Because solar flares and coronal mass ejections can cause magnetic storms in Earth's magnetosphere, SESC also reports on geospace conditions and the likelihood of a magnetic storm.

Forecasters in the SESC also monitor the near-Earth space environment. Solar flares produce vast amounts of X-rays and energetic protons which can be detected by NOAA satellites orbiting at geosynchronous altitudes. Energetic particles from the Sun and energized plasma in Earth's radiation belt environment can cause damage to satellites.


Today's Space Weather Report

Netscape: Magnetic Storms

Back Forward Home Reload Images Open Print Find Stop

Location: <http://lasagna.colorado.edu/ExploringSpace/SpaceWeather/RippingStorms/1.html>

What's New? What's Cool? Handbook Net Search Net Directory Software




SPACE SCIENCE INSTITUTE


Dedicated to excellence in space science research & education

A Magnetic Storm Rips Through Earth's Magnetosphere

During the month of March, 1989, a scientist strolling outside Arizona's Kitt Peak National Observatory observed a red glow in the night sky that he thought was caused by forest fires. Then, seeing a greenish fringe and vertical streamers reaching like ribbons above the horizon, he realized what it was - the aurora borealis, or Northern Lights. It was very unusual to see this mysterious and awe-inspiring phenomenon so far south of the arctic region where they are a common sight. Their appearance on this night was made possible by a series of events that began several days before on the Sun's surface some 93 million miles away. (Photograph of a red aurora courtesy of David Price © 1995.)



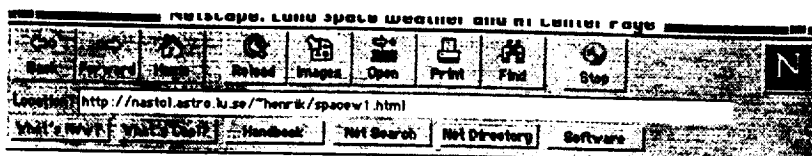
An immense area of sunspot large enough to contain 70 earth-size planets had come into view around the eastern rim of the Sun. Created by intense magnetic fields, the giant sunspot group suddenly brightened and expanded to cover hundreds of thousands of square miles. This solar eruption, called a flare, was accompanied by a huge burst of electromagnetic radiation and a large coronal mass ejection. The radiation, mostly in the form of X-rays, traveled at the speed of light and was detected on Earth about eight minutes after the flare erupted. Carried along by the solar wind that blows continuously away from the Sun at speeds of up to several million m.p.h., the energetic particles from this large solar flare happened to intercept Earth in its orbit around the Sun. (Photograph of a large sunspot group courtesy of the Space Environment Laboratory/NOAA.)



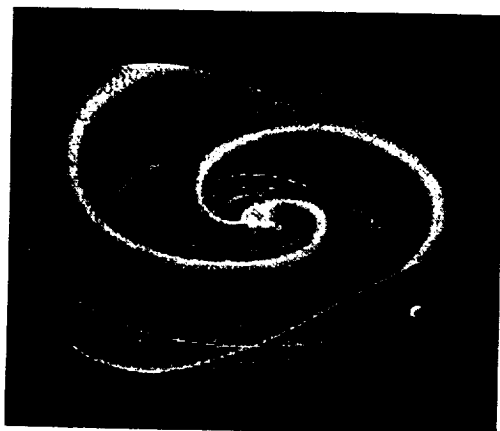
Sample of other Space Science Institute web pages.

<http://lasagna.colorado.edu/ExploringSpace/SpaceWeather/WeatherReport/1.html>

<http://lasagna.colorado.edu/ExploringSpace/SpaceWeather/RippingStorms/1.html>



LUND SPACE WEATHER AND ARTIFICIAL INTELLIGENCE CENTER



Very complete set of materials on space weather, the effects of space weather on technologies, the types of forecasts and research data sets including a listing of current and future space missions that are expected to provide important information.

Welcome

The Stanford painting shows the heliospheric current sheet and Earth's position. Thinking of Earth, as being inside the changing solar plasma and magnetic field makes it easier to understand how the Space Weather can affect technological systems, global climate and endanger human life.

We model and predict the space weather with the use of artificial neural networks and other methods of artificial intelligence.



Education



Forecasts



Effects

Research



Data



Space Missions



Computers

<http://nastol.astro.lu.se/~henrik/spacew1.html>

Netscape: Space Weather Tutorial Page

Location: <http://nastol.astro.lu.se/~henrik/spacw2.html>

What is space weather?

The interaction between the plasma and the magnetic field in the solar corona determines what kind of phenomena will occur in the corona and what type of Space Weather we will have. An unbalanced magnetic flux causes the magnetic field lines to open and a so called coronal hole (CH) is formed. From the CHs a fast stream of plasma (the solar wind) expands into the interplanetary space. From the so called coronal streamers (CSs) a slow stream of plasma is thought to expand into the interplanetary space. The fast solar wind catches up with the slow solar wind and an interaction region is produced.

Samplings of topics covered in the virtual library at the Lund Space Weather Site

<http://nastol.astro.lu.se/~henrik/spacw2.html>

Netscape: space weather forecasts

Location: <http://nastol.astro.lu.se/~henrik/spwfo.html>

Space weather forecasts

- Future forecast of the space weather 1 hour ahead.
- Forecast of the space weather 1-3 days ahead (NOAA/SEC).
- Alerts (NOAA/SEC).
- Real-Time Solar Wind Data (NOAA/SEC).

Use the histogram (Figure 1), showing the geomagnetic activity during several solar rotations, to make a first estimate of the geomagnetic activity as far ahead as one month. With further information about the solar coronal and solar wind activity that estimate can be improved.

<http://nastol.astro.lu.se/~henrik/spwfo.html>

Netscape: Space Weather Effects Page

Location: <http://nastol.astro.lu.se/~henrik/spwef.html>

Space weather effects

- On power systems.
- On satellite systems.
- On navigation systems.
- On communication.
- On manned space flights.
- On Earth's climate.

[Lund Space Weather and ALHAMBRA Page](#)

<http://nastol.astro.lu.se/~henrik/spwef.html>

Netscape: Space Weather Data Page

Location: <http://nastol.astro.lu.se/~henrik/spwd.html>

Space weather data

General Data:

- Today's space weather (NOAA/SEC).
- Coordinated Solar Observations (NOAA/SEC).
- Solar Terrestrial Physics (NGDC/NOAA).
- World Space Weather Service (IUWDS).
- Space Physics Data System (SPDS) on line data system.
- The World Data Center System.
- World Data Centre C1 for Solar-Terrestrial Physics (RAL).
- Solar Terrestrial Dispatch.

Solar Data:

- Current solar images (SDAC).
- Soft X-ray Telescope solar images (Lockheed/Palo Alto).
- Yohkoh SXT movies (SDAC).

<http://nastol.astro.lu.se/~henrik/spwd.html>

Netscape: Space Missions Page

Location: <http://nastol.astro.lu.se/~henrik/spacemissions1.html>

Space missions

The Solar Terrestrial Science Program (STSP) comprises SOHO and CLUSTER, and the International Solar-Terrestrial Physics Program (ISTP), with Geotail (ISAS-Japan), WIND and POLAR.

Geotail was launched in July 24, 1992.

WIND was launched on November 1, 1994.

ULYSSES reached 80 degrees south heliolatitude at 2.3 AU on 13 September 1994.

IMP-8.

SOHO was launched on December 2, 1995.

SOI, Solar Oscillations Investigation.

SPARTAN 201.

POLAR is scheduled for launch in January 12, 1996.

CLUSTER is scheduled for launch in the last quarter of 1995.

ACE (Advanced Composition Explorer) mission will be launched in 1997 and stationed at L1. NOAA and NASA has completed an agreement that will permit data from ACE to be subsampled and broadcasted continuously. NOAA/Space Environment Lab will herewith receive real-time solar wind data.

A selection of space missions relevant to space weather forecasting and research

<http://nastol.astro.lu.se/~henrik/spacemissions1.html>

Netscape: ISTP Project Information

Location: http://www-istp.gsfc.nasa.gov/ISTP/istp_project.html

ISTP Project Overview

Since the 1960s, the collaborative efforts by NASA, the European Space Agency (ESA), and the Institute of Space and Astronautical Sciences (ISAS) of Japan have led to the conception of the International Solar-Terrestrial Physics Science Initiative consisting of a set of solar-terrestrial missions to be carried out during the 1990s and into the next century.

This program coordinates resources and scientific communities on an international scale, acting as a complement of several missions, along with complementary ground facilities and theoretical efforts, to obtain coordinated measurements and investigations of the Sun-Earth space environment over the extended period of time.

The ISTP Science Initiative now encompasses and closely coordinated measurements from GEOTAIL, WIND, POLAR, SOHO, and CLUSTER. These measurements of the key regions of geospace will be supplemented by four other equatorial missions and ground-based investigations. The Equatorial missions include: the Geospace/Spacecraft Operational Environmental Spacecraft (GOES) Program of the National Oceanic and Atmospheric Administration (NOAA) and the Los Alamos National Laboratory (LANL) spacecraft from the Department of Energy (DOE). The ground-based investigations include:

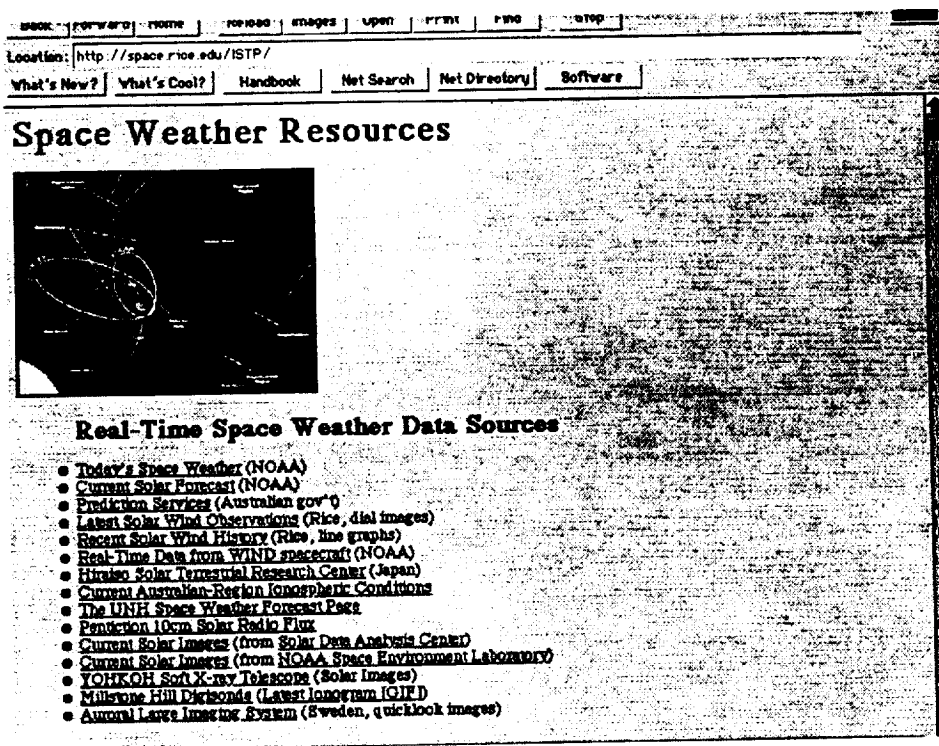
- DAWN - Dual Auroral Radar Network
- CANOPUS - Canadian Auroral Network for the Origin of Plasmas in Earth's Neighborhood Program United Study
- SHARAD - Satellite Experiments Simultaneous with Antarctic Measurements
- Radiation Belt Incoherent Scatter Radar

http://www-istp.gsfc.nasa.gov/ISTP/istp_project.html



Concise tour of space weather information abstracted from a museum exhibit.

<http://rigel.rice.edu/~dmb/spwea.html>



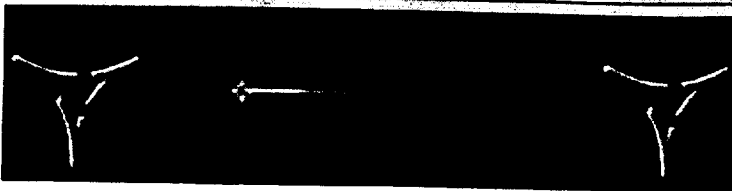
Hot Links to real-time space weather data and forecasting sites.

<http://space.rice.edu/ISTP/>

Back Forward Home Reload Images Open Print Find Stop

Location: <http://space.rice.edu/hmns/connect.html>

What's New? What's Cool? Handbook Not Search Not Directories Software



WELCOME TO THE "PUBLIC CONNECTION"
"Earth views of Space and Space views of Earth"
 An Outreach of Rice University
 In partnership with the Houston Museum of Natural Science

The Department of Space Physics and Astronomy at Rice University is "Creating the Public Connection" by means of a grant from NASA. The project has created the first digital museum accessible to the general public; by constructing four interactive displays of real-time earth and space science data at the Houston Museum of Natural Science (HMNS) and in other museums and schools around the country. This effort is part of NASA/Goddard's Digital Library Technology Project.

Project Director: Patricia Reiff
 Co-Director: Tamara Ledley
 Co-Director: Carolyn Summers (HMNS)
 Ryan Wyatt (HMNS)

Chief Designers: Colia Ian
 Colia McKay

New! Ask-the-Scientist Internet Videoconferences!

[ABOUT THE PUBLIC CONNECTION](#) | [FIRST YEAR ACCOMPLISHMENTS](#) | [OUR PROJECT IN THE NEWS](#)

Shortened versions of museum exhibits on Space Weather and related topics.

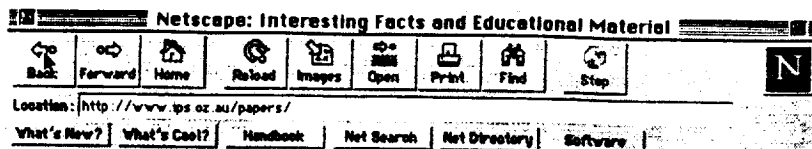
[ABOUT THE PUBLIC CONNECTION](#) | [FIRST YEAR ACCOMPLISHMENTS](#) | [OUR PROJECT IN THE NEWS](#)

Museum Module Samplers:

Comet Shoemaker-Levy 9
Welcome to Pinnet Earth
Space Weather
Latest space conditions (from the WIND spacecraft)
Houston Today
Space Update

Note: Our programs are written in Macromedia Director, a very robust multimedia display language. These web versions are abbreviated, just to give our web visitors a taste of what we are showing at the museum. Contact us for full museum or school versions for your site! See [ABOUT THE PUBLIC CONNECTION](#) for more details.

<http://space.rice.edu/hmns/connect.html>



Very complete space weather information site with lots of interesting images.

IPS Radio & Space Services

Interesting Facts and Educational Material

This area contains a series of occasional articles by IPS staff and their colleagues. Everything you always wanted to know about the Sun and ionosphere but were afraid to ask ...

The Sun - General Information

- [The Sun in Action!](#)
- [What is a Coronal Hole?](#)
- [High Resolution Images of the Sun](#)
- [A Summary of Solar Activity During 1994](#)
- [A Summary of Solar Activity During 1995](#)
- [The Most Active Solar Regions in the Last 20 Years](#)
- [The Distribution in X-Ray Class of Solar Flares](#)
- [The Ten Centimetre Solar Radio Flux](#)
- [Spectral Distribution of Radiation from the Sun](#)

The Solar Cycle

- [Cycle 23 Summits Reached at Learmonth Solar Observatory](#)
- [The First Sign of the New Solar Cycle](#)
- [Butterflies and the New Solar Cycle](#)
- [What is the Sunspot Number?](#)
- [Observed and Predicted Sunspot Numbers](#)
- [Large Monthly Sunspot Numbers](#)
- [The Amplitude of the Solar Cycle 23](#)
- [Is the Solar Cycle Declining?](#)
- [The Length of the Solar Cycle](#)
- [The Phase of the Solar Cycle](#)
- [Large Solar Flares During Cycles 21 and 22](#)

The Earth's Magnetic Field

- [The Occurrence of Geomagnetic Disturbances](#)
- [The Seasonal Distribution of Geomagnetic Disturbances](#)
- [Historical Large Geomagnetic Disturbances](#)

The Earth's Ionosphere

- [What is the IPS T Index](#)
- [Have You Heard an Aurora?](#)
- [Explanation of Auroral Sounds](#)

Effects of Solar Activity

- [The Diverse Effects of Solar Events](#)
- [Solar Activity and Satellite Lifetimes](#)
- [Solar Interference to Satellite Communications](#)
- [Satellite Outages Caused by Sun](#)
- [Power Failure in Canada During 1989](#)

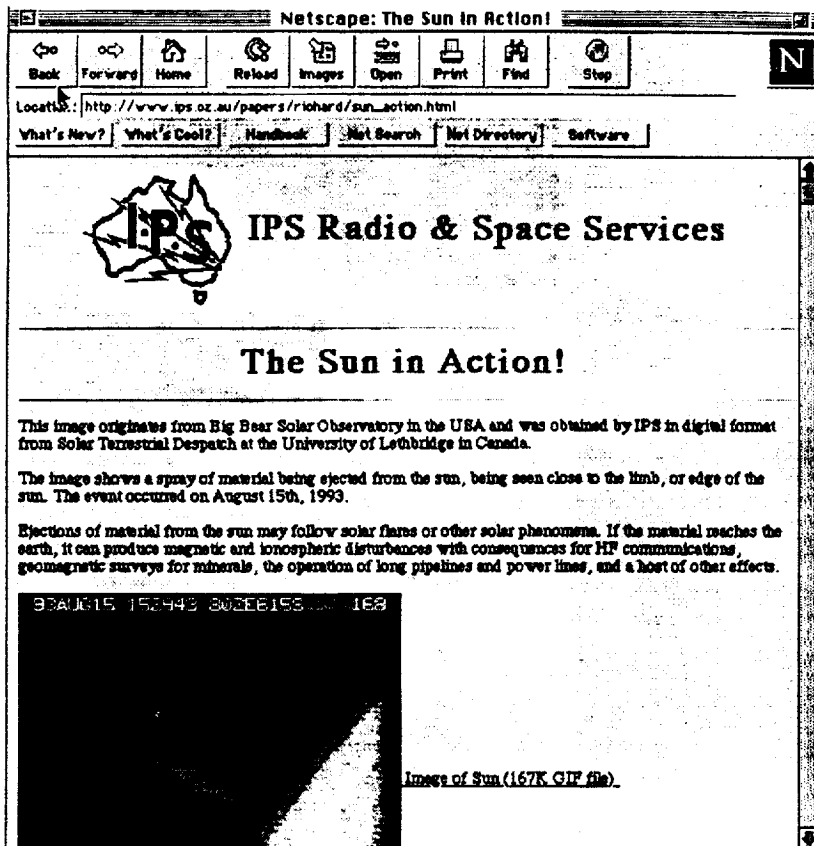
IPS Observations

- [The Calcutt Radiometerograph](#)

General

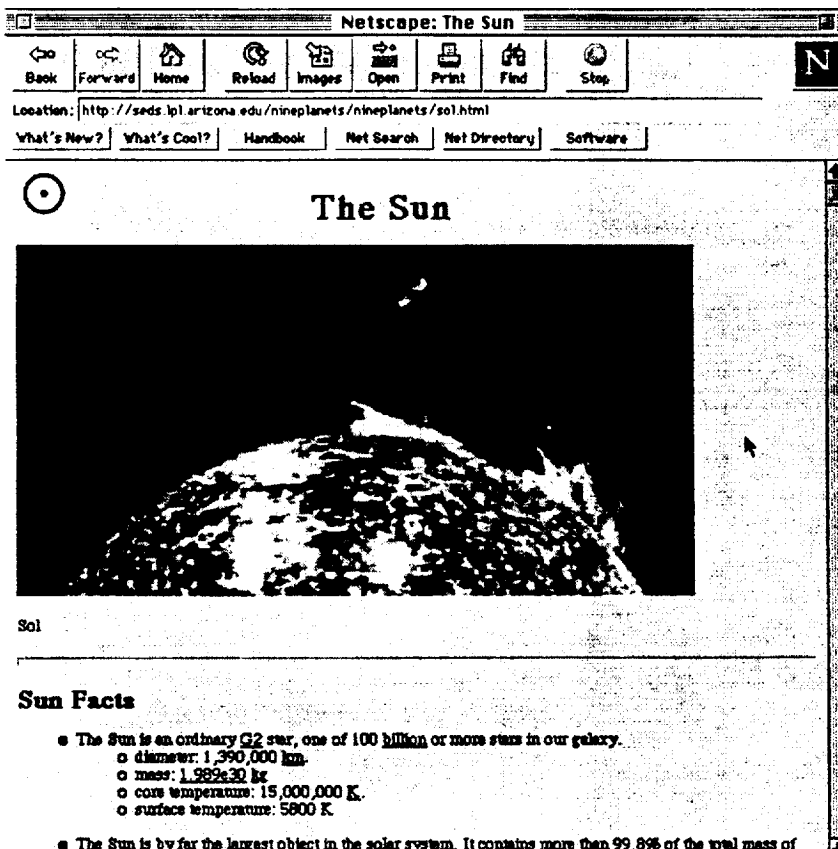
- [A Quiz About the Near Space Environment](#)
- [Ours Atmosphere](#)
- [The Day of Earth](#)
- [What is a Solar Eclipse](#)
- [Solar Eclipses in the Next 10 Years](#)

<http://www.ips.oz.au/papers/>



An example of the IPS science pages

http://www.ips.oz.au/papers/richard/sun_action.html



An enjoyable multi-media exploration of the sun.


<http://seds.lpl.arizona.edu/nineplanets/sol.html>

Back Forward Home Reload Images Open Print Find Stop

Location: <http://lepmp.gsfc.nasa.gov/Education/intro.html>

What's New? What's Cool? Handbook Not Search Not Directory Software

The Exploration of the Earth's Magnetosphere



Click [here](#) for a full version (12-K) of this image.

Ever since the launch of the first Sputnik in 1957, space exploration has advanced on two fronts, manned and unmanned. The manned missions are well known—from Mercury, Gemini and Apollo, to the Space Shuttle and the proposed Space Station Freedom. Millions have watched "Apollo 13" or "The Right Stuff."

In contrast, the exploration of space by unmanned spacecraft has remained almost invisible. The world applauded in 1958, when Explorer 1 and 3 discovered the radiation belt, but the many missions which afterwards explored the Earth's magnetic environment in much greater detail are virtually unknown.

Here is a glimpse of that other side of the space adventure, of the key missions which have probed Earthspace. The complex and active magnetic environment which they have discovered includes:

- The magnetosphere, the region dominated by the Earth's magnetic field. Here energetic particles are trapped and fast electrons are produced, then flung down into the atmosphere to produce the polar aurora or "northern lights." Unmanned probes also discovered magnetospheres around most major planets.
- The fast solar wind, flowing out of the Sun in all directions, hammering in the Earth's magnetosphere while supplying the energy which powers the aurora and drives geospace phenomena.
- The many types of high energy particles found in space, including those energized by the Earth's magnetosphere, by the Sun's magnetic fields and by unknown distant sources among the stars. All over the universe a surprisingly large amount of energy seems to go to such particles, and we are only beginning to understand how it might happen.

On-line review of the Earth's magnetosphere.

<http://lepmp.gsfc.nasa.gov/Education/intro.html>

NetScape: SCIENCE

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.telegraph.co.uk/et/access?ac=118215403348&pg=//95/8/17/sciflo17.html>


What's New? What's Cool? Handbook Not Search Not Directory Software

The Electronic Telegraph Thursday 17 August 1995 Science

electronic Telegraph Science

Winner 20-25 age group: A ghostly wind

Nicholas Flowers describes a mission to study the winds that stream through the solar system



LOOKING up at Mars tonight you might be forgiven for thinking that a ghostly wind blows between Earth and the red planet. Actually, solar system space is bathed in the ever-present flow of the Sun, a fact betrayed to us only during auroral displays.

This atmosphere is tenuous and insubstantial. Streaming out of the Sun is the solar wind - a wind with less than 10 particles per cubic centimetre (cup your hands together ... you are holding 300 million million million particles of air). Compared with our atmosphere it would appear as thin as air is to rock, and existing in it would not dislodge one hair on your head although it would be moving past at 400 km/s.

This ghost of a wind is so hot that its constituent electrons and ions are stripped apart. As charged particles, they are subjected to the magnetic forces of the Earth's field trapping some in the magnetosphere - the comet-shaped region where the magnetic field of the Earth dominates particle motion. Less than 500kg of particles can be trapped in the magnetosphere, but because of their energy they can be as deadly to spacecraft as the myriad fragments of broken rocket known as space debris.

Scientists hope to learn more about the solar wind and the hazards in near-earth orbit in January when the European Space Agency launches the four spacecraft of the Cluster mission. The craft will fly in closely choreographed orbits to probe the dimensional nature of the Sun's interaction with the Earth's magnetic fields.

Cluster will be launched on the maiden flight of the powerful new European Ariane V, and will be injected into a polar orbit. This orbit will annually rotate from the magnetoid to the magnetosphere's boundary layer and out into the volatile solar wind, permitting observations of the complex physics of many regions.

The spacecraft are expected to last two years, taking the satellites through a punishing regime of particle radiation every 26 hours and sending electronic enhancements to data from the mission's various instruments.

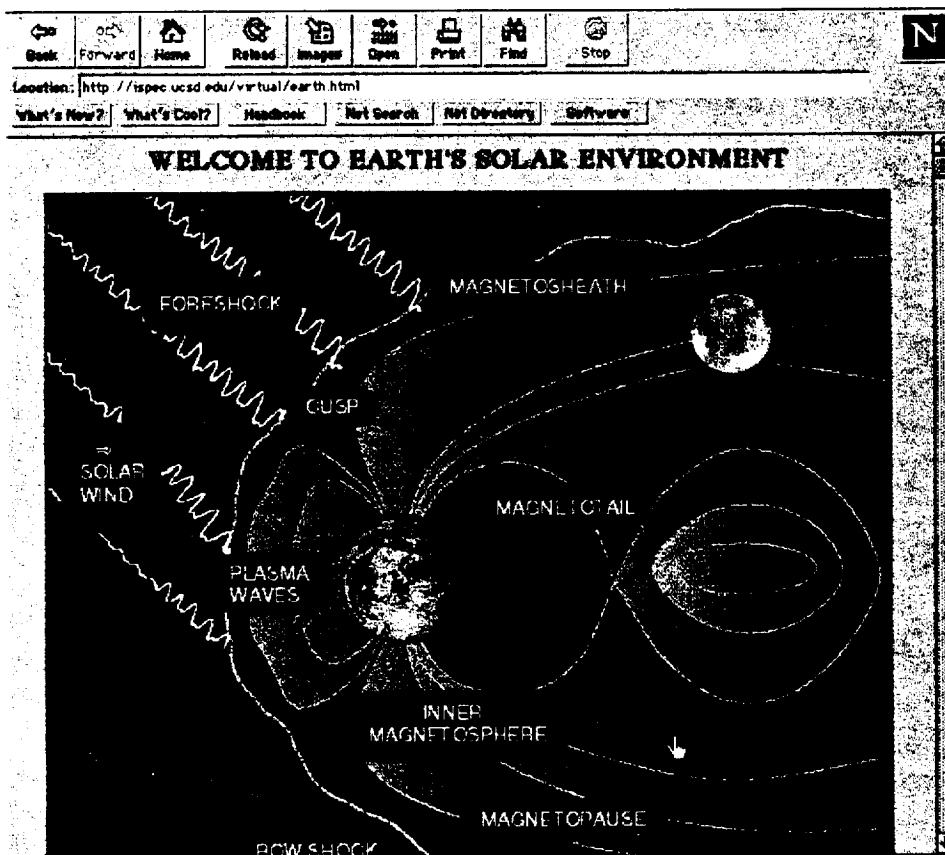
Award winning article on the solar wind.

<http://www.telegraph.co.uk/et/access?ac=118215403348&pg=//95/8/17/sciflo17.html>



Image Intensive
tour including the
sun and the earth's
plasma environment.

<http://ispec.ucsd.edu/virtual/>




<http://ispec.ucsd.edu/virtual/earth.html>

Back Forward Home Reload Images Open Print Find Stop

Location: <http://ispec.ucsd.edu/virtual/sun.html>

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ISPEC

International Space Physics Educational Consortium

ONLINE MATERIAL FOR THE SUN

THE NINE PLANETS - SUN - SEDS	ISPEC
The Solar System - LANL	
Space Physics Textbook - OULU	ISPEC
Today's Space Weather - NOAA/SEI	
Latest Solar Images - Solar Data Analysis Center (SDAC)	
Yohkoh Solar Movies - SDAC	
Eclipse Images and Movies - SDAC	
The Sun - SEDS	

Sample of ISPEC
HOT LINKS

<http://ispec.ucsd.edu/virtual/sun.html>

Back Forward Home Reload Images Open Print Find Stop

Location: http://umbra.gsfc.nasa.gov:80/yohkoh/movies/SXT_movies.html

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Yohkoh SXT Movies

Yohkoh and SXT

The earth-orbiting *Yohkoh* ("Sunbeam") satellite of the Institute of Space and Astronautical Sciences (ISAS), Japan, is able to observe the Sun in wavelengths inaccessible from the surface of the earth. Every day, the *Yohkoh* Science Team releases, through the *Hinode* Solar Terrestrial Research Center of the Communications Research Laboratory (CRL), a single, full field-of-view, soft X-ray image of the Sun obtained by the Soft X-Ray Telescope (cf. *Transactions of the IAGG, Volume 156, 37*) in the "dogwood" (Al-Mg-Mn) filter, which is most sensitive to plasmas at temperatures $\sim 2 \times 10^6$ K. These images, downloaded from *Hinode*, are available from the SDAC in FITS format via anonymous ftp. The Soft X-ray Telescope (SXT) was designed by the Lockheed Palo Alto Research Laboratory, the National Astronomical Observatory of Japan, and the University of Tokyo with the support of NASA and ISAS. The Project Manager for *Yohkoh* is Prof. Yoshiko Ogawa of ISAS, and the Project Scientist is Prof. Tetsuka Uchida of the Department of Astronomy, University of Tokyo.

The Movies

- **SXT 1993 and 1994** (Distorted QuickTime movie format, 10 frames per second, 256 x 256 pixels, 1.7 Mbyte)
- **SXT 1993 January - 1994 August** (Distorted QuickTime, 15 fps, 256 x 256 pixels, 27.2 Mbyte)
- **SXT 1994 January - August** (Distorted QuickTime, 15 fps, 256 x 256 pixels, 9.1 Mbyte)
- **SXT 1994 January - May** (Distorted QuickTime, 15 fps, 128 x 128 pixels, 1.5 Mbyte)

Using the Interactive Data Language (IDL) from Research Systems, Inc., we first wrote FITS format files of each image. Then, using Adobe Premiere 4.0 on an Apple PowerMacintosh 8100/60, we create a QuickTime movie from the FITS. In this process, the original images, mostly 512 x 512 pixels (a few of 256 x 256), are reduced to 256 x 256 to prevent the movie file from being even more enormous than it already is. (The 1994 January - May movie is reduced to 128 x 128 pixels so that those without the large bandwidth necessary to download the other movies can still see what the Sun looks like in soft X-rays over a period of months.)

The 1993/1994 movie is composed at 10 frames per second, a time compression factor of nearly 870,000. We use the Apple V-Mac CODEC (image compression scheme), and a quality of "high" to compress the QuickTime movies. The other movies were originally produced with the shareware program "MovieMaker," and run at different frame rates.

The movie files are accessible in "flat" format, so that they can be used by QuickTime for Windows or X-Anim on X-Window systems, as well as on Macintoshes with QuickTime.

All the movies are silent.

Movies of the Sun
in Soft X-rays

http://umbra.gsfc.nasa.gov:80/yohkoh/movies/SXT_movies.html

Netscape: Sample Solar Data

Location: http://nssdc.gsfc.nasa.gov/solar/sample_images.html

What's New? What's Cool? Handbook **Net Search** Net Directory Software

Sample Solar Data

H-alpha Image



[Click on the image to view the original](#)

This image of the Sun in the H-alpha spectral line of hydrogen emission (6563 Angstrom Units), a line which is often used in the study of solar flares because flares typically heat their sites enough to emit this red light conspicuously. The bright area is a solar flare, which extended over 300,000 km (200,000 miles) across the surface of the Sun, and which was an extremely copious source of high-energy protons (10 - 100 MeV). The flare lasted for over an hour and produced enough high-energy proton radiation to kill an astronaut standing on the Moon in a space suit. Flares with this radiation output occur rarely - only a handful per decade - at unpredictable time. If astronauts had been on the Moon, they would have needed a warning to enter a protective structure or cover themselves with lunar soil for protection. A Space Shuttle flight was in progress during this flare, and a space walk was not scheduled, but would have been harmful if necessary; the hull of the Shuttle was sufficiently shielding to the crew, but they noticed irritating flashes of light as a few of the most energetic protons penetrated the hull and their eyes.

This image was made at Holloman Air Force base and provided at 512 x 512 pixel resolution. It was displayed on an IBM PC compatible using software written by Dr. David Batchelor (SPDF), and then encoded as a GIF. Such images are available from the NOAA Space Environment Lab (SEL), and are known as SELSIS images (SIS - Solar Image System). The PC software is available from D. Batchelor. NOAA is the source for the SELSIS image data files.

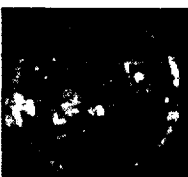
Soft X-ray Image



[Click on the image to view the original](#)

This image of the Sun in the wavelength band 3 - 45 Angstrom Units, recorded with the Soft X-ray Telescope aboard the Japanese/USA spacecraft Yohkoh (the Japanese word for sunlight). The globe of the Sun can be seen as dark because it is not hot enough to emit X-rays. The bright areas surrounding the dark globe are hot clouds of gas (1 to 2 million degrees K) in the Sun's corona, which glow in X-rays. The appearance of bundles or skeins of threads is due to the magnetic field of the Sun, which traps and constrains the forms of the clouds, as well as playing a still poorly-understood role in heating the clouds to such a higher temperature than the Sun's surface (5800 deg K). Scale: the Sun's diameter is approximately 1,400,000 km (840,000 mi.). ISAS is the Japanese space agency. Yohkoh data becomes publicly available 2 years after acquisition, through the SDAC or NSSDC.

X-ray Spectrographic Image



[Click on the image to view the original](#)

This image of the Sun in the wavelength band 2 - 32 and 44 - 54 Angstrom Units, recorded with X-ray Spectrographic Telescope aboard the Skylab space station on 1973 June 19 at 06:19 hours Universal Time. The globe of the Sun can be seen as dark because it is not hot enough to emit X-rays. The bright areas surrounding the dark globe are hot clouds of gas (1 to 2 million degrees K) in the Sun's corona, which glow in X-rays. The appearance of bundles or skeins of threads is due to the magnetic field of the Sun, which traps and constrains the forms of the clouds, as well as playing a still poorly-understood role in heating the clouds to such a higher temperature than the Sun's surface (5,800 deg K). Scale: the Sun's diameter is approximately 1,400,000 km (840,000 mi.). This image has been processed to enhance the sharpness of its features, using the unsharp masking process, which suppressed features larger than 73,000 km in size. On the left edge (or east limb) of the Sun, a large magnetized arch of gas is visible; this feature lasted several hours.

Provides insights into the uses and interpretation of various types of solar images.

http://nssdc.gsfc.nasa.gov/solar/sample_images.html

Netscape: Views Of The Solar System

Back Forward Home Reload Images Open Print Find Stop

Location: <http://bang.lanl.gov/solarsys/homepage.htm>

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Views Of The Solar System


Compiled by [Gordon A. Harrison](#), Los Alamos National Laboratory (LANL)

• [Important Note from the Author & Copyright Information](#)


Views of the Solar System has been created as an educational tour of the solar system. It contains images and information about the Sun, planets, moons, asteroids, comets and meteoroids found within the solar system. It contains over 200 pages of information, over 970 high-resolution images and animations, and over 640 megabytes of data. The image processing for many of the images was done by the author.

This tour uses hypertext to allow space travel by simply clicking on a dashed planet. This causes information and images about the planet to appear on screen. While on a planet page, hyperlinks travel to pages about the moons and other relevant available resources. Universal terms are linked to and defined in the *Glossary* page. Detailed information of the planets and satellites can be browsed through sorted lists. The *History of Space Exploration* contains information about rocket history, early astronauts, space missions, spacecraft and detailed chronology tables of space exploration. The *Table of Contents* page has links to all of the various pages within *Views Of The Solar System*.


- [Table of Contents](#)
- [Cover Page](#)
- [What's New](#)
- [Mirror Sites](#)
- [Image and Animation Index](#)
- [Solar System Introduction](#)



Sun



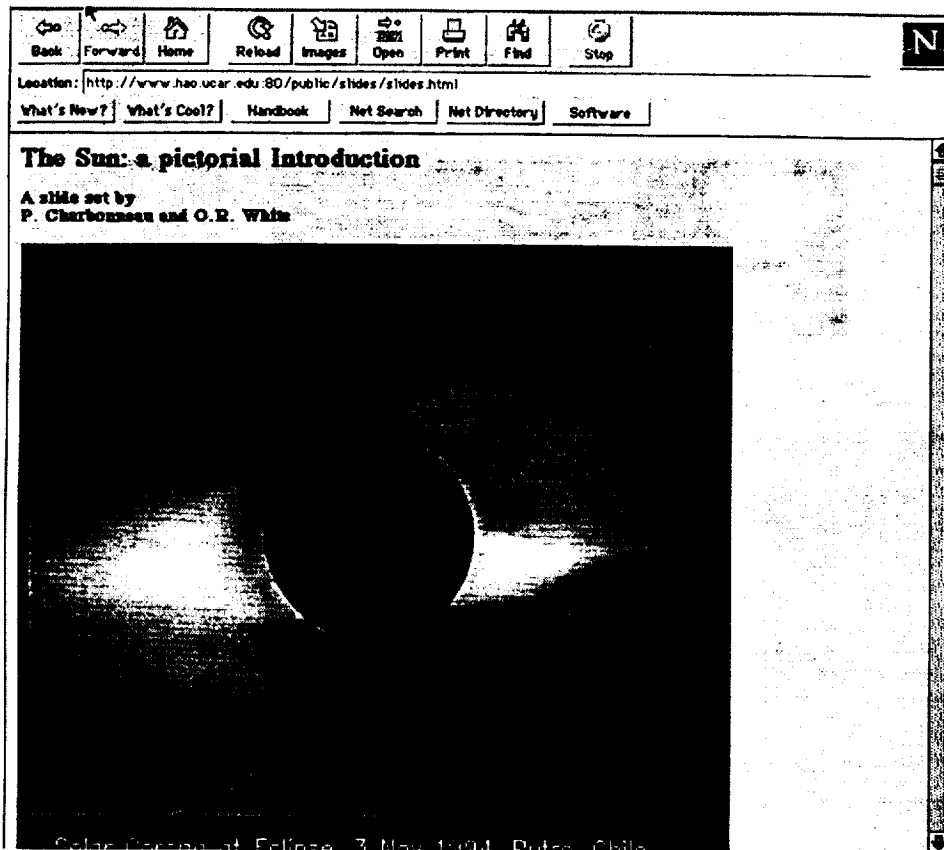
Mercury



Venus

Image-intensive tour of the sun and planets.

<http://bang.lanl.gov/solarsys/homepage.htm>



Very informative and visually appealing slide show of solar phenomena.

Some excellent hypertext resources on the Sun are available at:

- Bill Arnett's (LPL) [The Nine Planets: A Multimedia Tour of the Solar System](#)
- Calvin J. Hamilton's (LANL) [Views of the Solar System](#)
- The US High Altitude Observatory's ["What is the Sun?"](#)
- Charbonneau and White's (HAONCAR) [The Sun: A Pictorial Introduction](#)
- the US National Solar Observatory's [Sacramento Peak Observatory exhibit](#)
- the Royal Greenwich Observatory's leaflet, [The Solar System](#)

For current images of the ever-changing solar atmosphere, and for solar-terrestrial activity information, take a look at:

- the Solar Data Analysis Center's [current solar images page](#)
- the NOAA Space Environment Laboratory's (SEL's) [solar images page](#)
- NOAA SEL's [space weather page](#)

Useful Hot Links

<http://www.hao.ucar.edu:80/public/slides/slides.html>

Atmospheric Phenomena in the Virtual Library

New Phenomena

Web site offering images, historical notes and research summary of the curious, newly-documented upward lightning discharges.

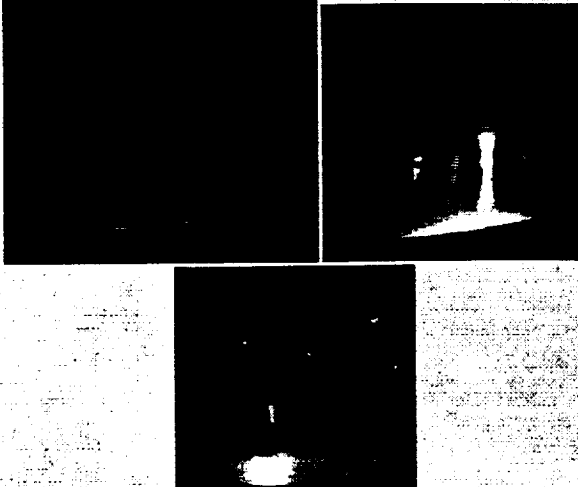
Netscape: Red Sprites and Blue Jets

Location: <http://elf.gi.alaska.edu/sprites.html>

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Red Sprites and Blue Jets

(This page is still under construction)



- Introduction
- Characteristics of Red Sprites
- Characteristics of Blue Jets
- Why Haven't Sprites and Jets Been Reported Before?
- How to Look For Sprites and Jets
- Current Research Focus

Introduction

Red sprites and blue jets are upper atmospheric optical phenomena associated with thunderstorms that have only recently been documented using low light level television technology.

The first images of a sprite were accidentally obtained in 1989 (Frazer *et al.*, 1990). Beginning in 1990, about twenty images have been obtained from the space shuttle (Yanich *et al.*, 1992; Ruck *et al.*, 1994).

Since then, video sequences of well over a thousand sprites have been captured. Most of these images have been obtained during summer campaigns in 1993 and 1994. These include measurements from the ground (Lyons, 1994; Winkler, 1995) and from aircraft (Sentman and Wescott, 1993; Sentman *et al.*, 1995).

Numerous images have also been obtained from aircraft of blue jets (Wescott *et al.*, 1995), also a previously unrecorded form of optical activity above thunderstorms. Blue jets appear to emerge directly from the tops of clouds and shoot upward in narrow cones through the stratosphere. Their upward speed has been measured to be about 100 km per second.

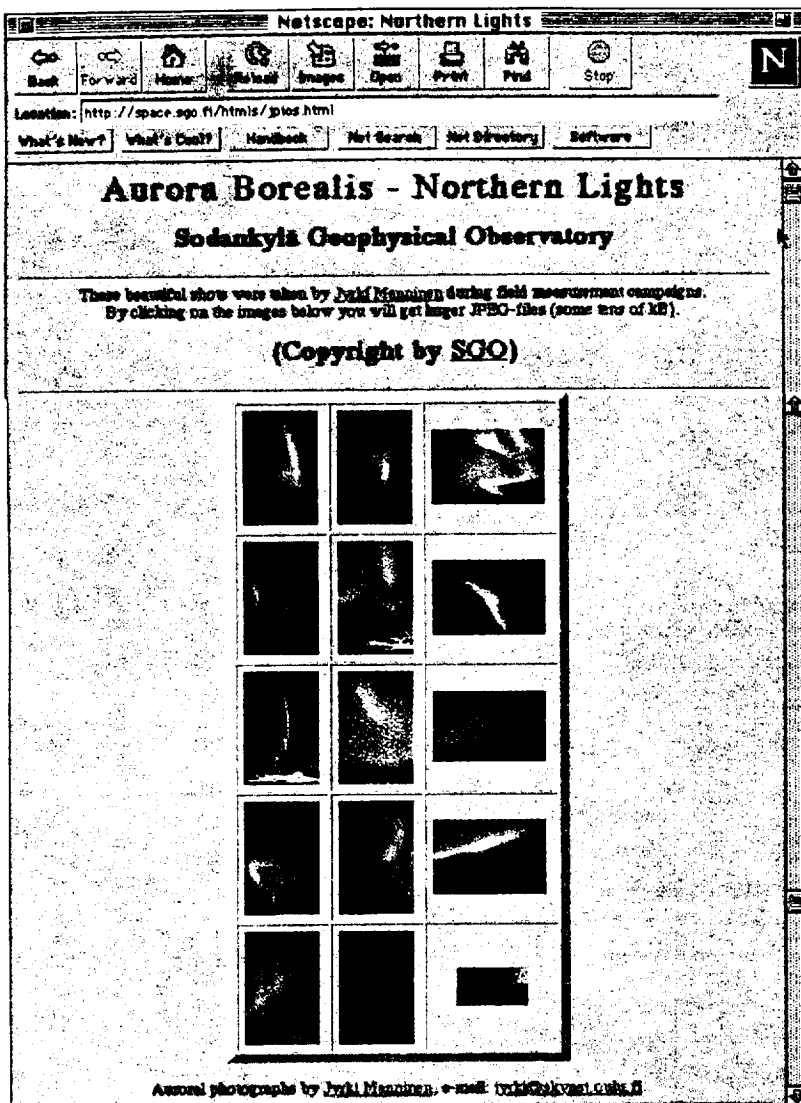
In addition to sprites and jets, but possibly related, there have recently been observed from space two other types of unexpected emissions that appear to originate in thunderstorms. Short duration (~1 use) gamma ray (>1 MeV) bursts of terrestrial origin have been detected by the Compton Gamma Ray Observatory. They are observed to occur over thunderstorm regions, and their source is believed to lie at altitudes greater than 30 km. Finally, extremely intense pairs of VHF pulses (Trans-Ionospheric Pulse Pairs, or TIPPES (TIPP Paper Postscript Sprites) originating from thunderstorm regions, but some 10,000 times stronger than sferics produced by normal lightning activity, have been observed by the ALEXIS satellite.

Anecdotal reports of "rocket-like" and other optical emissions above thunderstorms go back more than a century (Lyons, 1994), and there have been several pilot reports of similar phenomena (Yanich and Yonnegard, 1989). Gamma ray bursts and TIPPES were discovered less than two years ago. Together, these phenomena suggest that thunderstorms exert a much greater influence on the middle and upper atmosphere than was previously suspected.

<http://elf.gi.alaska.edu/sprites.html>

Breathtaking Auroral Sites

A gallery of auroral images from Finland.



<http://space.sgo.fi/htmls/jpics.html>

Netscape: Aurora Borealis - the northern lights

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.uit.no/npt/nordlyset/waynorth/OO-innhold.en.html>

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Northern Lights

Aurora Borealis

- the northern lights

Contents

1. Introduction
2. The northern lights and folklore
3. What causes the northern light
4. The earth's magnetic field
5. Aurora outbreak
6. Quantum leap
7. Three Norwegian pioneers
8. The northern lights oval
9. Northern lights and climate

Interesting source of information on the aurora and its history.

<http://www.uit.no/npt/nordlyset/waynorth/OO-innhold.en.html>

Netscape: Aurora Borealis - the northern lights, Introduction

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.uit.no/npt/nordlyset/waynorth/O1.en.html>

What's New? What's Cool? Handbook Net Search Net Directory Software

Northern Lights

Aurora Borealis

- the northern lights

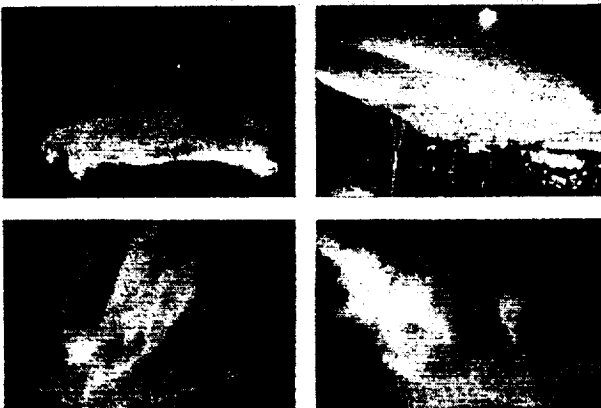
Frank Pettersen

The Northern lights are poetry, they are nature's light show, and they are quantum leaps in the oxygen storm. They are elementary particle physics, superconduction, superconductivity and fairy tales. The northern lights have filled people with wonder and inspired artists; they have frightened people to think that the end is at hand. More exact explanations of the phenomena could not be given until modern particle physics was developed, and knowledge about details in the earth's magnetic sphere has been based on measurements from satellites.

When the northern lights are seen over Tromsø, it happens in a set pattern, although this pattern varies considerably. The outbreak starts with a phosphorescent glow over the horizon in north west. The glow dies out and comes back, and then an arch is lit. It drifts up over in the sky. And new arches are lit and follow the first one. Small waves and curls move along the arches. (Picture 1).

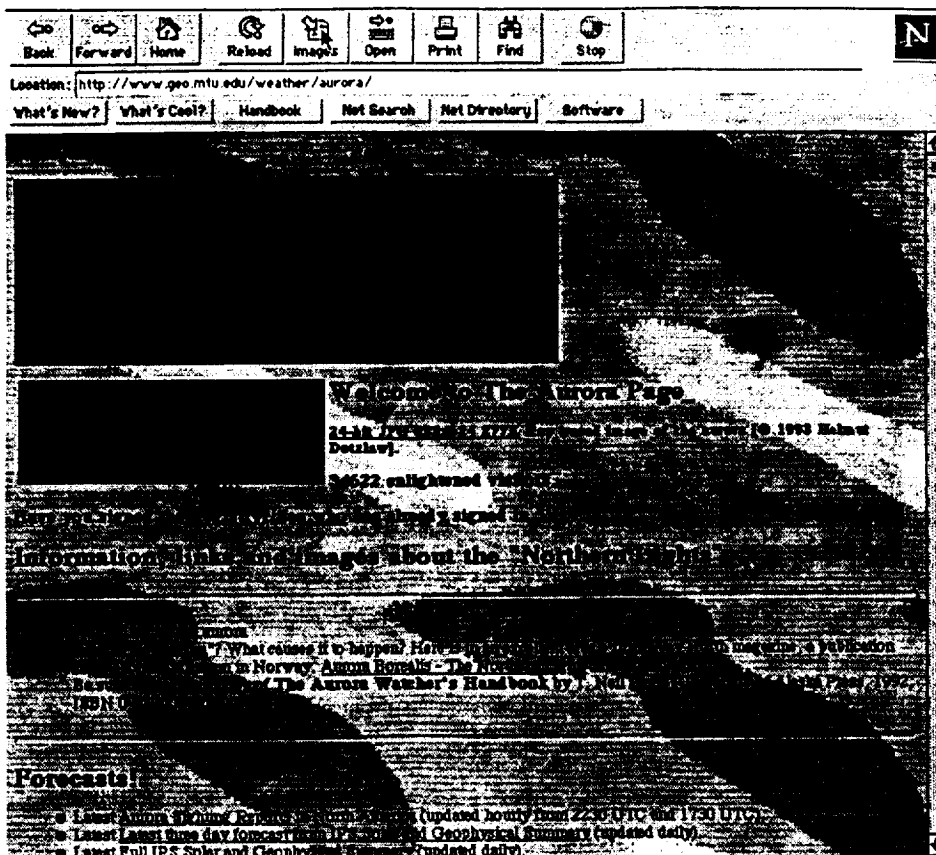
Then within a few minutes a dramatic change is seen in the sky. A deluge of particles hit the upper atmosphere in what is called an aurora sub-storm. Rays of light shoot down from space, forming draperies which spread all over the sky. And they really remind us of draperies or curtains which are flickering in the wind. And you can see a violet and a red trimming at the lower and upper ends. Or the colors are mixed all together, woven into each other. The curtains are disappearing and forming all over again by new rays of light shooting down from space. Above our head we can see rays going out in all directions forming what is called an aurora corona. After 10 to 20 minutes the storm is over and the activity decreases. The bands are spread out, disintegrating in a diffuse light all over the sky. We can not see individual patches of light, but the total effect is bright enough to enable us to make out details of the countryside around us. If we look very carefully, we can see the remains of the northern lights display as faint, pulsating flames. Clouds of light which is turned on and off regularly every 5 - 10 seconds as though by an electric light-switch. The nature's own gigantic light-show is over.

Fig. 1. Different phases in a northern lights outbreak.



(Photo: Frank Pettersen)

<http://www.uit.no/npt/nordlyset/waynorth/O1.en.html>




Beautiful auroral images from Northern Michigan.

<http://www.geo.mtu.edu/weather/aurora/>

Back Forward Home Reload Images Open Print Find Stop

Location: http://www.ips.gov.au/papers/richard/auroral_sound_explan.html

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IPS Radio & Space Services

Are Auroral Sounds A Real Physical Effect?

Colin Keay, University of Newcastle

It is very likely that the sounds sometimes heard during auroral displays are produced in a similar way to the rare examples of instantaneous sounds from very large meteor fireballs, which were a mystery for more than two centuries. Very briefly, the turbulent plasma wake of the fireball excites electromagnetic waves in the Earth-ionosphere cavity. The allowed modes lie in the kilohertz region of the spectrum. In the case of a fireball as bright or brighter than the Moon, megawatts of electromagnetic energy are produced and the electric vector is strong enough to excite acoustic vibrations in suitable objects, such as loose hair or frozen pine needles. The resulting sounds are heard as hissing, swishing or crackling by anyone in close proximity.

This explanation was developed by me to explain the widely perceived sounds from the huge New South Wales fireball in 1978. It was published in 1980 in the *SCIENCE* journal (Volume 210, pages 11-15). I was quickly able to prove in laboratory tests that rapidly varying electric fields could be heard provided there was something near the observer to act as a transducer. Even wearing a pair of glasses could raise a subject's threshold by 3 or 4 decibels. Later tests with mundane materials in an anechoic chamber verified that all sorts of objects could respond to rapidly fluctuating electric fields and produce faint sounds.

Detection of the ELF/VLF electromagnetic radiation from a meteor fireball was a much harder problem because such events are very rare. The Japanese succeeded, publishing proof of the existence of such radiation in 1986. This difficult feat has since been repeated by a team of Canadian astronomers using a video recorder. These have finally laid to rest the fallacious conventional wisdom that instantaneous fireball sounds are psychological in origin.

The same is probably true for auroral sounds. They only occur during extremely intense auroral displays, when, according to Olsen (*Pure & Applied Geophysics* vol 84, 1971) abnormally high electric fields have been measured. Very rapid fluctuations in such fields excite the audible sounds if suitable transducer materials are present. I am sure that attempts to record auroral sounds on a tape recorder, with a microphone lying on the snow, failed because there was nothing nearby to act as a transducer. If the microphone had been placed under a pine tree, instead of out in the open, the result may have been very different.

An exploration of the mystery of auroral sounds.

http://www.ips.gov.au/papers/richard/auroral_sound_explan.html

Effects of the Space Environment

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Location: <http://medlib.jsc.nasa.gov/intro/humans.html>

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SBR

SPACE BIOMEDICAL RESEARCH INSTITUTE

HUMANS IN SPACE

Can human beings live and work in space? The short answer, from the early Soviet and Mercury missions, is yes. Those early missions proved that people can function in space, and that they could operate complex space vehicles under stressful conditions. This document examines the question in more detail and provides an introduction to the basic problems and theories of space biomedical research.

This document is divided into several sections. You can page through the document, or you can jump straight to the section you're interested in:

- Introduction
- Physiologic Systems
 - The Cardiovascular System
 - Blood and its Components
 - The Fluid Regulation System
 - The Respiratory System
 - The Immune System
 - The Musculoskeletal System
 - The Nervous System
- Spacecraft Systems
 - Environmental Control and Life Support System
- Frequently Asked Questions
 - Astronaut food
 - Astronaut health care
 - Astronaut personal hygiene
 - Astronaut to vacuum
 - Sex in space
- Conclusion

van Allen belts

earth

SOLAR WIND

SOLAR FLARE

GALACTIC COSMIC RAYS

Figure 1. Radiation hazards of space.

GALACTIC COSMIC RAYS

Frequency and distribution

Annual dose: 10 REM

Discussion of the impacts of the space environment on humans with an interesting section on radiation hazards.

<http://medlib.jsc.nasa.gov/intro/humans.html>

Space Weather Prediction Infrastructure

Draft Interagency Space Weather Implementation Plan

<http://www.nsf.gov:80/geo/atm/nswp.htm>

Netcape: National Space Weather

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.nsf.gov:80/geo/atm/nswp.htm>

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National Space Weather Program

Implementation Plan

Draft 12/7/95

This paper is a draft document, not for quotation or citation. Please e-mail comments and suggestions to Rich Behnke, Section Head, Upper Atmosphere Research Section, Division of Atmospheric Sciences, National Science Foundation, e-mail: rbehnke@nsf.gov.

Download the Document

- Word 6.0 Version
- De-limited text file

Contents

I. Introduction

- A. Space Weather System
- B. Relevance to the Nation
- C. Summary of the Strategic Plan

II. Capabilities, Goals, and Strategy

- A. Current Capabilities
- B. Operational Goals
- C. What Needs to be Done

Netcape: Intro

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Location: <http://www.nsf.gov:80/geo/atm/intro.htm#>

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National Space Weather Program

Implementation Plan

Draft 12/7/95

This paper is a draft document, not for quotation or citation. Please e-mail comments and suggestions to Rich Behnke, Section Head, Upper Atmosphere Research Section, Division of Atmospheric Sciences, National Science Foundation, e-mail: rbehnke@nsf.gov.

I. Introduction

As the world moves into the twenty-first century, our civilization is relying more and more on technology that is affected in some way by conditions in the space environment. To prepare ourselves to deal with these vulnerabilities, several U. S. government agencies have developed a program called the National Space Weather Program (NSWP). "Space weather" refers to conditions on the sun and in the solar wind, magnetosphere, ionosphere, and thermosphere that can influence the performance and reliability of space-borne and ground-based technological systems and can endanger human life or health. In 1994 a strategic plan was developed that described the goals, program elements, and the agency responsibilities of the NSWP. It was prepared by representatives of those government agencies whose responsibilities include space weather. The strategic plan was reviewed by each of the agencies and approved. At the time the strategic plan was approved, the agencies recommended that program planning continue with the development of an implementation plan. This document presents the implementation plan for the NSWP. It begins with an overview of space weather, an explanation of the importance of space weather, and a summary of the Strategic Plan upon which this plan is based. A summary of current capabilities and operational goals, and a top-level roadmap for the program follow in Section II. Section III presents the meat of the plan—how research will be conducted to improve our understanding of space weather physics, and to improve our models and sensors. Section IV acknowledges that research results alone will not address space weather needs, and presents a plan to transition the newly acquired technology to operational use. Section V introduces a plan for broad improvement in knowledge about space weather through a comprehensive education program. The plan concludes with sections describing program priorities, management structure, and agency roles and responsibilities. The NSWP Implementation Plan is the culmination of months of multi-agency coordination and represents a dedicated effort by Federal agencies to improve capabilities in an area that has critical societal impacts.

<http://www.nsf.gov:80/geo/atm/intro.htm#>

Location: <http://web.ngdc.noaa.gov/stp/GLOSSARY/glossary.html>

ON-LINE GLOSSARY OF SOLAR-TERRESTRIAL TERMS

Taken from the SEPC Glossary of Solar-Terrestrial Terms, DOONOA/ERL/REL

Jump To:

A B C D E F G H I K
L M N P Q R S T U V
W X Z

A INDEX. A 3-hourly "equivalent amplitude" index of local geomagnetic activity; "A" is related to the 3-hourly **K INDEX** according to the following scale:

K	0	1	2	3	4	5	6	7	8	9
A	0	3	7	15	27	48	80	140	240	400

A INDEX. A daily index of geomagnetic activity derived as the average of the eight 3-hourly A indices.

ACTIVE. Geomagnetic levels such that 15 is less than **A_g** which is less than 29.

ACTIVE. Solar activity levels with at least one geophysical event or several larger radio events (10cm) per day (Class H Flares).

ACTIVE BARE FILAMENT (ABF). An **ACTIVE PROMINENCE** seen on the **DISC**.

Handy reference for defining space weather terms.

<http://web.ngdc.noaa.gov/stp/GLOSSARY/glossary.html>

Location: <http://igpp.ucla.edu/spa/scientists.html>

Who's Who in Space Physics

Directory of Space Scientists' Personal Home Pages

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

If you would like to include your personal page in this list, please send the URL to scientists@igpp.ucla.edu

A

- Acheron, Kent L. (U Iowa)
- Aikin, Anna (U Ohio)
- Alcock, Richard C. (Phillips Lab/AFMC)
- Aspin, John David (NRC Canada)
- Asfour-Abdalla, Maha (UCLA)

B

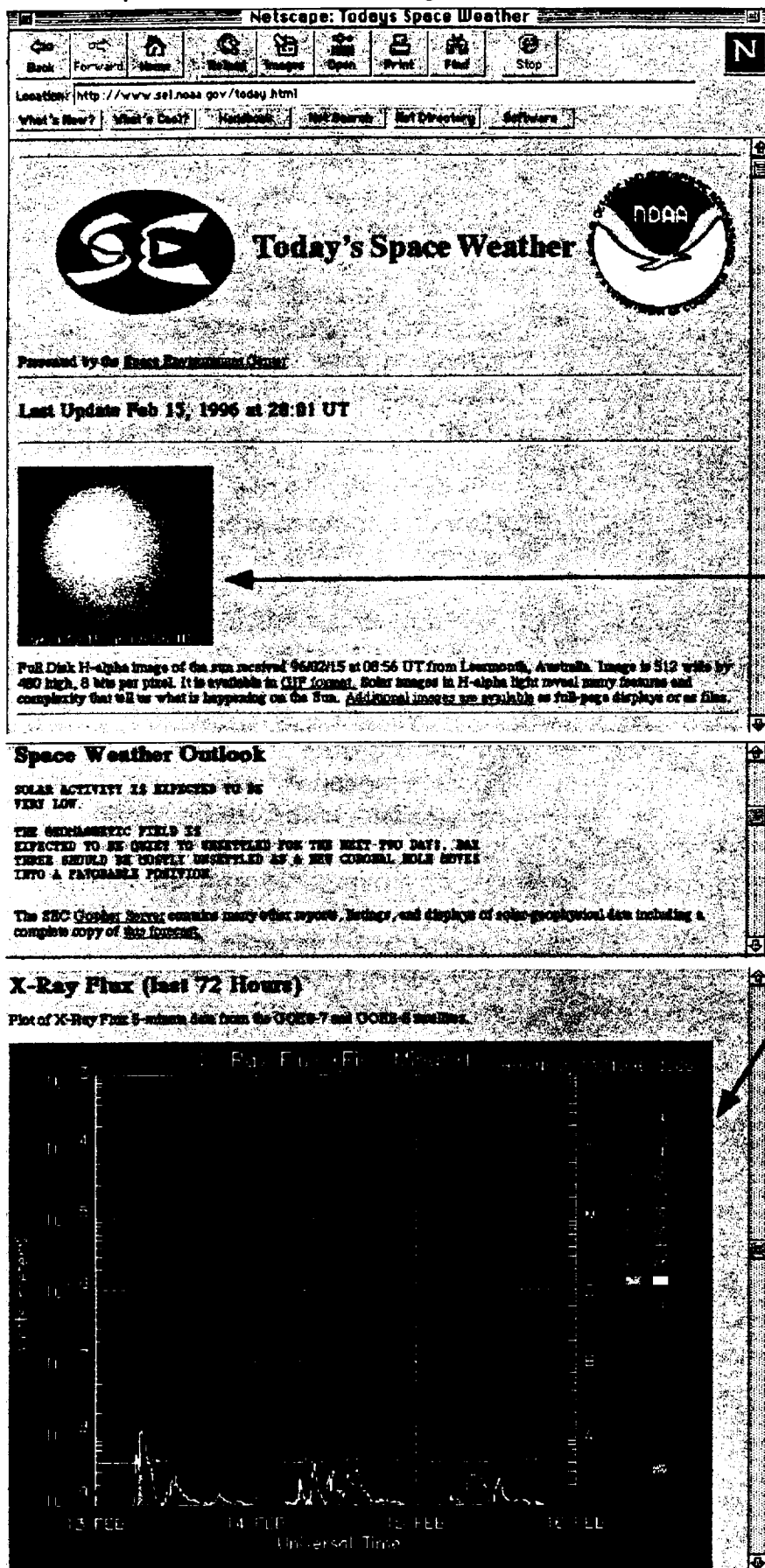
- Bergman, Fran (U Colorado)
- Baker, K. B. (JHU/APL)
- Barr, Charles A. (U Colorado)
- Barnes, Lynn E. (BU)

Links to the web home pages of space scientists (not comprehensive but growing)

<http://igpp.ucla.edu/spa/scientists.html>

Real-Time Data and Forecasting Sites

Unprecedented access to real-time data streams is now available on the web for browsers who want up to the minute knowledge of weather conditions in space.



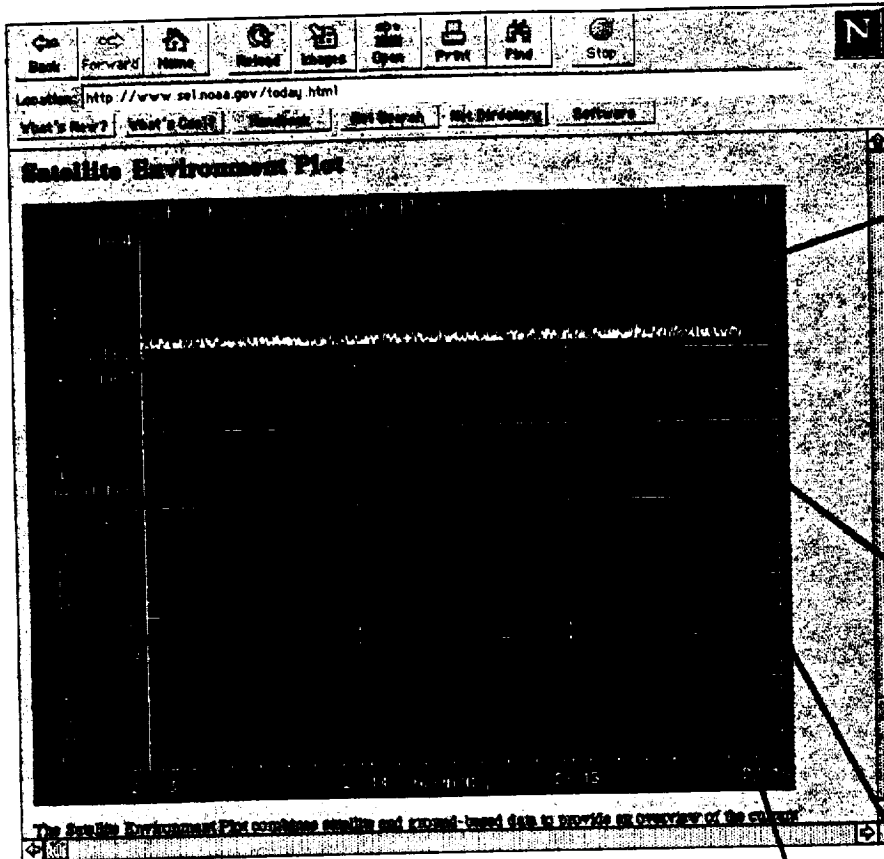
Real-time information on solar conditions and the state of the Earth's magnetosphere are available at SEL's web site. Space Weather predictions are made daily. The following brief bullets describe the types of real-time data displayed and what to look for in these data displays.

An image of the solar disk in H-alpha line is provided daily. This type of light originates in the chromosphere (which lies just above the visible surface). Solar active regions (flares, plages, filaments, sunspot groups) are easily seen at these wavelengths. A large solar flare can release up to 10^{32} ergs in 1000 seconds and fills space with ultraviolet light, xrays and energetic particles.

The xray fluxes, plotted in this panel, are the total fluxes arriving from the sun as seen at geosynchronous orbit by the GOES satellites. Flares produce greatly enhanced x-ray fluxes which reach the Earth within 8 minutes from the flare site on the sun. The levels here are low originating from a quiet sun. Enhanced levels can be seen associated with flares. Flares are classified by their xray flux output as:

Class	Xray Flux ($\times 10^{-6} \text{ W/m}^2$)
C	1 - 10
M	10 - 100
X	> 100

<http://www.sel.noaa.gov/today.html>



This set of panels provides an overview of conditions encountered by satellites at geosynchronous orbit. Clicking on any panel to get an expanded view and some explanation of the plot parameters.

The first panel gives the summed proton flux over several energy ranges. When the >10 MeV proton flux (red line) reached a flux >10 protons/cm²/s/sr, warning of a suspected proton flare is issued. The dashed line indicates the level at which satellite anomalies have been seen.

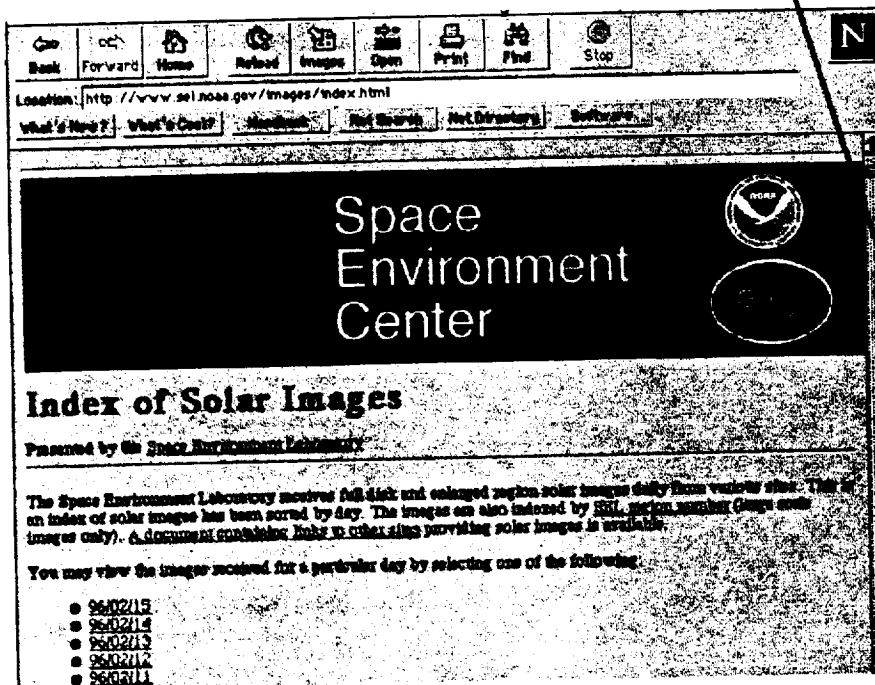
The second panel gives the summed electron flux over several energy ranges. When the >2 MeV flux (red line) exceeds 1000 electrons/cm²/s/sr a warning is issued. At this level, problems with spacecraft charging are known to have occurred.

H_p is a measure of the geosynchronous magnetic field component \sim parallel to the Earth's rotation axis. If this field becomes negative on the dayside, the outer boundary of the Earth's magnetosphere has likely been pushed inside geosynchronous orbit exposing spacecraft to negative and highly variable magnetic fields.

The last panel gives the estimated planetary K index, which is a measure of the irregular variations in the Earth's magnetic field. The variations reflect the degree of magnetic activity (storminess).

Kp value	Conditions
4	active
5	minor storm
≥ 6	major or severe storm

<http://www.sel.noaa.gov/today.html>



<http://www.sel.noaa.gov/images/index.html>

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Location: <http://www.sel.noaa.gov/images/950707.html>

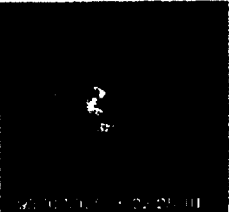
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Space Environment Center

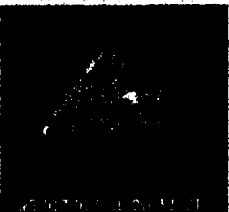
Solar Images Received 95/07/07

Processed by the Space Environment Laboratory

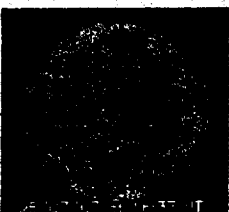
Images are indexed by day (full disk and large scale images) and by SEL sector number (large scale images only). You also may be interested in [links to other sites providing solar images](#) or in [images from the May 1994 solar eclipse](#).




Large-scale image of Region RC14 in H-Alpha received 95/07/07 at 22:26 UT from Holloman AFB, New Mexico. Image is 512 wide by 480 high, 8 bits per pixel. It is available in [GIF format](#) and [FITS format](#).



Full Disk H-alpha image of the sun received 95/07/07 at 20:33 UT from Holloman AFB, New Mexico. Image is 512 wide by 480 high, 8 bits per pixel. It is available in [GIF format](#) and [FITS format](#).



Full Disk Helium 10830 image of the sun received 95/07/07 at 18:27 UT from Kitt Peak, Arizona. Image is 512 wide by 480 high, 8 bits per pixel. It is available in [GIF format](#) and [FITS format](#).



Full Disk Magnetogram image of the sun received 95/07/07 at 15:42 UT from Kitt Peak, Arizona. Image is 512 wide by 480 high, 8 bits per pixel. It is available in [GIF format](#) and [FITS format](#).

Solar images come in various wavelength ranges and each of these images has something different to tell us about conditions on the sun. A brief explanation is given for each type of image along with tips on what features are of interest.

The first two images are views at different resolutions of the sun in the red H-alpha emission line of hydrogen. This emission comes mainly from the chromosphere (the layer just above the sun's visible surface). Active regions (i.e., flares, plages, filaments, and sunspots) are highly visible at these wavelengths. Solar active regions are associated with the development of magnetic storms at the Earth.

The third image is a view of the full solar disk in He 10830 emission. From this emission line, information about the sun's corona (the sun's outermost layer, visible during eclipses) can be inferred. Active regions and prominences appear black, while coronal holes (associated with recurrent magnetic activity on the Earth) appear light.

The final image shows the polarity and surface distribution of the sun's magnetism. Dark regions have south polarity, bright regions north polarity. Sunspots usually appear in groups of two with opposite polarity. Polarities are reversed as you move from the sun's northern to southern hemisphere.

<http://www.sel.noaa.gov/images/950707.html>

Navigation: [Back](#) [Forward](#) [Home](#) [Search](#) [Print](#) [Stop](#)

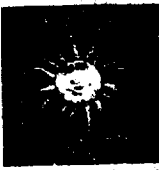
Location: <http://umbra.nascom.nasa.gov/images/latest.html>

What's New? What's Cool? **Headlines** Not a Member? Not a Member? Software


Current solar images

Click on any of the following thumbnail images for the most recent, full-resolution solar image of each type in the SOHO archive (the time and date of the image are in *yyyy-mm-dd hh:mm:ss* format).


Note: The SOHO EIT instrument is still being commissioned. As a result, these EIT images may not be updated daily. Even after the commissioning is complete, it will be some time before the image quality is acceptable. In the meantime, the EIT Principal Investigator and the EIT Consortium invite you to enjoy these unprecedented views of the extreme ultraviolet Sun. (Currently, the images are reproduced at full, 1024 x 1024 resolution, and so are quite large -- 700 - 800 K bytes.)




© 2001-2002 Extreme Ultraviolet Imager Telescope (EIT) and Gold Foil EX 171 Å images from NASA
Goddard Space Flight Center (1996-02-15 16:29:57)



© 2001-2002 Extreme Ultraviolet Imager Telescope (EIT) and Gold Foil EX 195 Å images from NASA
Goddard Space Flight Center (1996-02-15 04:55:34)



© 2001-2002 Extreme Ultraviolet Imager Telescope (EIT) and Gold Foil EX 284 Å images from NASA
Goddard Space Flight Center (1996-02-15 16:19:25)



© 2001-2002 Extreme Ultraviolet Imager Telescope (EIT) and Gold Foil H 304 Å images from NASA
Goddard Space Flight Center (1996-02-15 16:24:32)

<http://umbra.nascom.nasa.gov/images/latest.html>

The latest SOHO images of the sun

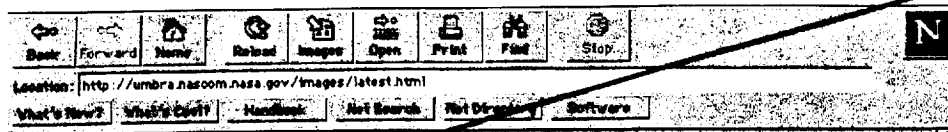
Extreme ultraviolet emissions come from regions of the sun at extremely high temperatures - the chromosphere (just above the sun's visible surface) and the corona (the sun's outermost layer).

Mystery of the Solar Transition Region

One of the current solar mysteries is how the corona is able to maintain extremely high temperatures (> 1 million K) while the chromosphere (separated from the corona by only a thin transition region) has a temperature that is 100 times cooler. This question is one major focus of the SOHO mission. The images on the left are of spectral lines that form in thin altitude ranges within the transition region. Using these images, scientists hope to understand the structure of this layer separating the chromosphere and corona.

In addition to exploring the transition region, these images can provide other important information. The third image shows emissions from Fe XV (14 times ionized iron) which forms at temperatures found in the corona. Million degree coronal loops, when they occur, are visible at this wavelength.

The fourth image is in H α 304 Å, which forms at temperatures of $\sim 80,000$ K. Such temperatures occur in solar eruptions and coronal loops, making these structures easily visible.



Yohkoh Soft X-ray Telescope (SXT) full-disk images from the Hinode Solar Terrestrial Research Center (JSTEC, Japan) [12-FEB-96 02:03:29]



Photograph taken from the U.S. National Solar Observatory at Kitt Peak (Arizona) [15-FEB-1996 15:03:56]

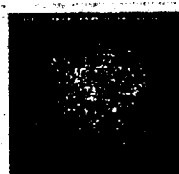


He I 10830 Å emission image from the U.S. National Solar Observatory at Kitt Peak (Arizona) [15-FEB-1996 16:51:18]

Soft x-rays reveal the presence of very hot gases ($>2 \times 10^6$ K). Because solar flares and active regions heat the gas to extremely high temperatures, these structures appear clearly in soft x-rays images. The rest of the sun is dark, since its temperature is much lower.

This is a solar magnetogram which shows the polarity and surface distribution of the sun's magnetism. Dark regions have south polarity, bright regions north polarity. Sunspots usually appear in groups of two with opposite polarity. Polarity reverses when moving from the sun's northern to southern hemisphere.

Information about the sun's corona (outermost layer) can be inferred from He 10830 emission. Active regions and prominences appear black, coronal holes (sometimes associated with recurrent magnetic storms at the Earth) appear light.



He I 10830 Å emission image from the U.S. National Solar Observatory at Sacramento Peak (New Mexico) [14-FEB-1996 15:09]



White-light coronagraph image from the High Altitude Observatory Mauna Loa Solar Observatory (Hawaii) — daily, 9:00 image [14-FEB-1996 16:03]

The entire FTS database set up to one year before present is available for scientific and educational use, thanks to the generosity of the Yohkoh science team. If you know the dates and times for which you would like data, and from what FTS instrument, send an e-mail request to public_data@yohkoh.sciencelinks.gov or public_data@yohkoh.sciencelinks.gov.

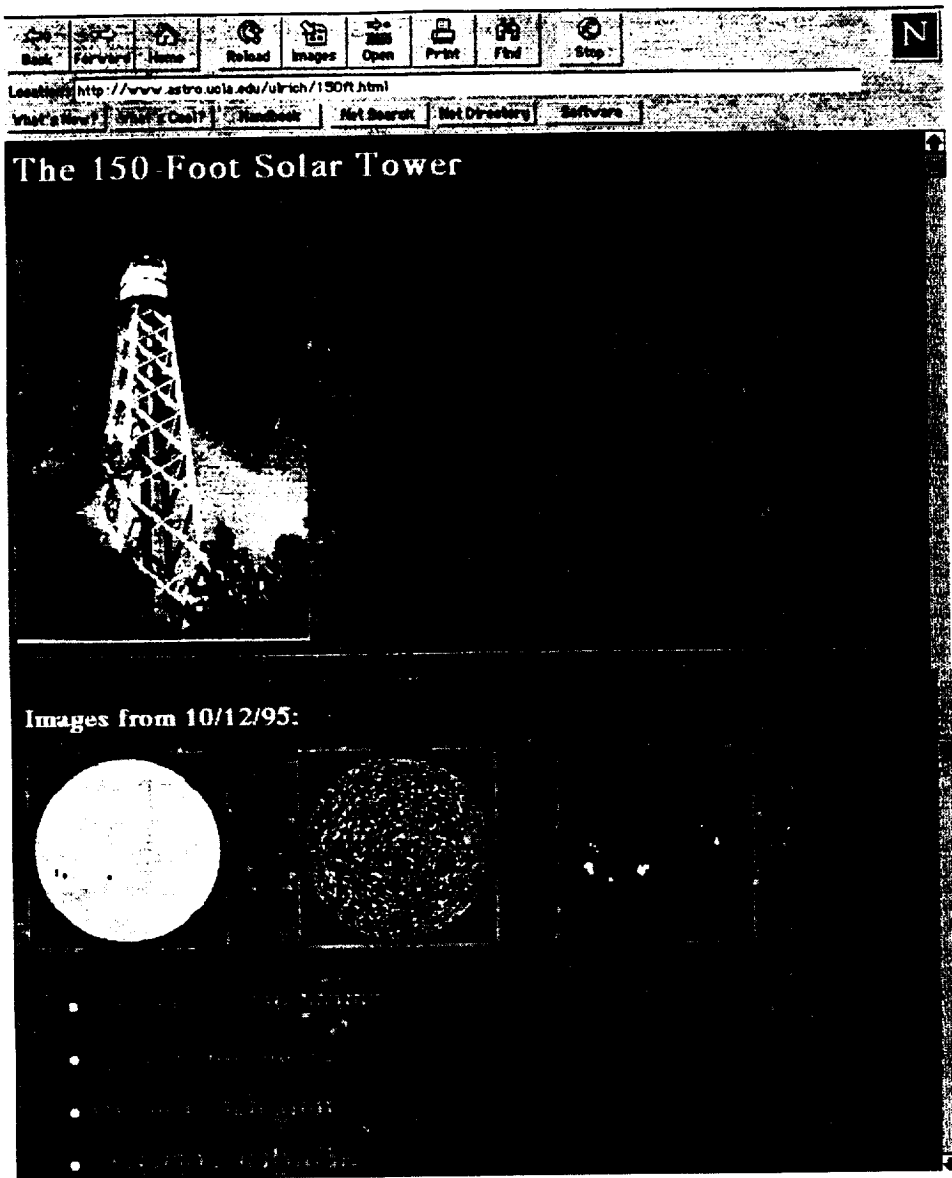
Data requested in this manner can be found <http://umbra.nascom.nasa.gov>.

If you are unfamiliar with the FTS instruments or the analysis software, consult the online introduction to the analysis of FTS data.

Images the chromosphere (shell of gas several thousand kilometers thick above the sun's visible surface). This emission clearly outlines the boundaries of supergranules (large convection cells) that extend into the chromosphere from the underlying photosphere (sun's visible surface).

This is an image of the corona taken after blocking out the sun's visible face with an occulting disk. Features which may appear include giant expanding bubbles called coronal transients and coronal mass ejections sometimes associated with magnetic storm on Earth.

<http://umbra.nascom.nasa.gov/images/latest.html>

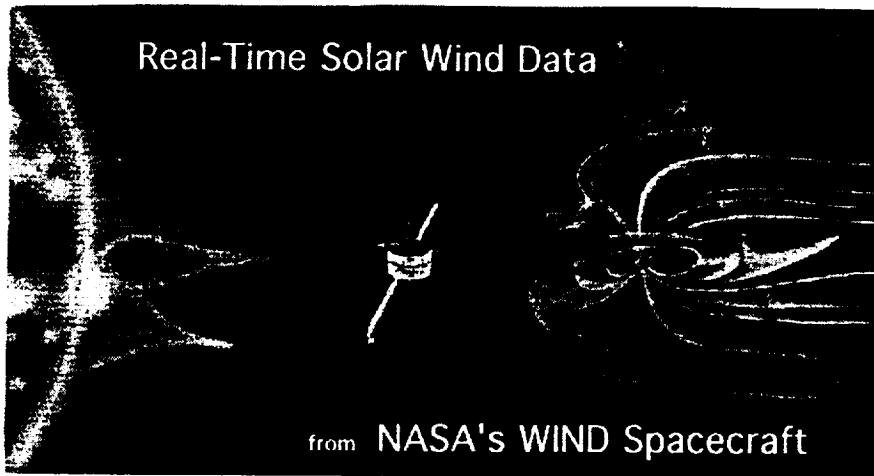


Solar Images from the
150 Foot Solar Tower

<http://www.astro.ucla.edu/ulrich/150ft.html>

The great Greek philosopher Heracleitus once said you can never step in the same river twice because the river is continuously changing as it flows by you. Like the river, the solar wind changes speed, density and structure in an ever-evolving outward flow. The solar wind is formed as the sun's topmost layer, the corona, blows outward into space. The interaction between the solar wind and the Earth's magnetosphere is responsible for triggering magnetic storms.

<http://www.sel.noaa.gov/wind/rtwind.html>



These pages are updated in real-time as solar wind data is received at the NOAA Space Environment Center (SEC). They are designed to be accessed using a W3 browser that supports dynamic documents and tables (Netscape v1.1 or later, for instance). These data are provided for operational use through agreement with the International Solar Terrestrial Physics Science Initiative (ISTP). They should not be published or cited without first contacting the Principal Investigator (PI) of the WIND experiment of interest (please see the PI list through the WIND Contacts link below).

At this web site, maintained by Rice University, the solar wind information, returned by the WIND spacecraft, is displayed on a series of dials. In the first row, the solar wind density, speed and pressure are indicated. Average solar wind densities are ~3-10 particles/cc. Average speed is ~400 km/s. However, in high speed streams, velocities can reach or exceed 600-1000 km/s. In the next line of plots, the magnetic field embedded in the solar wind flow is displayed. Average magnetic fields are ~6 nT but can reach 20-30 nT. Southward interplanetary magnetic field values are associated with the development of geomagnetic storms.

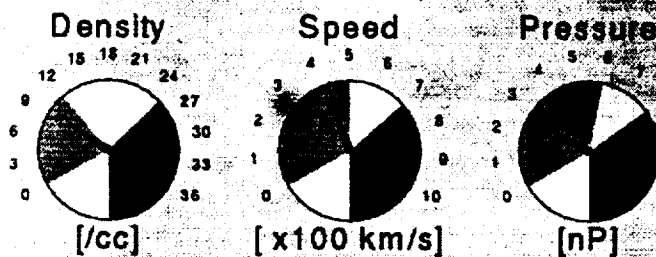
<http://space.rice.edu/ISTP/dials.html>

SPACE WEATHER:

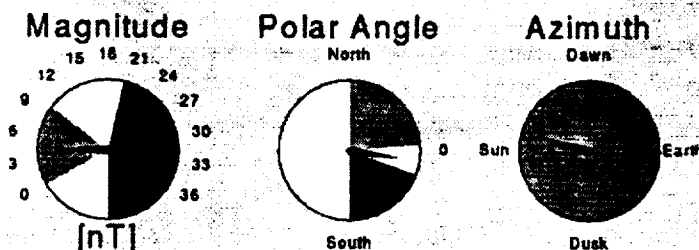
Latest Observations from the WIND Spacecraft

Measurement ETA at Earth: February 15, 1996 17:08 UT

Solar Wind



Interplanetary Magnetic Field



Space Weather Forecasting Services

Predictions by the Big Bear Solar Observatory of impending solar flares and the development of active regions on the sun.

<http://sundog.caltech.edu/WWW/bear.html>

Daily forecasts of solar activity and of the occurrence probability and magnitude of associated geomagnetic storms.

<http://www.sel.noaa.gov/forecast.html>

Navigation: Back Forward Home Reload Images Open Print Find Stop

Location: <http://sundog.caltech.edu/WWW/bear.html>

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the BEARALERT program

The BEARALERT program of predicting solar flares or rapid development of activity in certain sunspot groups was inaugurated in December 1997 by the Big Bear Solar Observatory (BBSO) in order to test the current understanding of the flare process by making public predictions via electronic mail. Neither the exact timing of the flare nor the possibility of emergence of new active regions can be predicted. However, high-resolution observations of the magnetic configuration, H-alpha brightness and structure, and other properties of a region have enabled the BBSO astronomers to announce the onset of many major active regions. See also: Zirin & Marguete, *Solar Physics*, 131, p. 149-164

Requests for subscription to the BEARALERT mailing list should be sent to: bearalert@bbsso.caltech.edu. Please give your email address, affiliation, and full name.

Click here to get the latest message (if any): **BEARALERT**

Author:
William H Marguete WHM@BBSO.caltech.edu

Navigation: Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.sel.noaa.gov/forecast.html>

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Space Environment Laboratory

Prepared jointly by the U.S. Dept. of Commerce, NOAA, Space Environment Center and the U.S. Air Force.

JOINT USAF/NOAA REPORT OF SOLAR AND GEOPHYSICAL ACTIVITY
SUN NUMBER 046 ISSUED AT 2200Z ON 15 FEB 1996

IA. ANALYSIS OF SOLAR ACTIVE REGIONS AND ACTIVITY FROM 14/2100Z TO 15/2100Z: SOLAR ACTIVITY WAS VERY LOW. THERE WAS NO ACTIVITY NOTED OVER THE PAST 24 HOURS. NEW REGION 7945 (N06W05), AN ACTIVE SPOTTED REGION, WAS FORMED TODAY.

IB. SOLAR ACTIVITY FORECAST: SOLAR ACTIVITY IS EXPECTED TO BE VERY LOW.

IIA. GEOPHYSICAL ACTIVITY SUMMARY FROM 14/2100Z TO 15/2100Z: THE GEOMAGNETIC FIELD WAS BENEATH QUIET TO UNSETTLED LEVELS FOR THE PAST 24 HOURS. THE GREATER THAN 2 MEV ELECTRON FLUX RANGED FROM MODERATE TO HIGH LEVELS OVER THE PAST 24 HOURS.

IIB. GEOPHYSICAL ACTIVITY FORECAST: THE GEOMAGNETIC FIELD IS EXPECTED TO BE QUIET TO UNSETTLED FOR THE NEXT DAY. VERY MOSTLY UNSETTLED FOR THE REMAINDER OF THE FORECAST PERIOD. HIGH LATITUDES WILL LIKELY EXPERIENCE UNSETTLED TO ACTIVE LEVELS ON DAYS 2 AND 3 AS A RECURRENT, BUT WEAK, CORONAL HOLE MOVES INTO A FAVORABLE POSITION.

III. EVENT PROBABILITIES 16 FEB-18 FEB

CLASS II 01/01/01
CLASS I 01/01/01
PROTON 01/01/01
PCAF GREEN

IV. PERTINENT 16.7 CM FLUX
OBSERVED 15 FEB 049
PREDICTED 16 FEB-18 FEB 070/072/073
90 DAY MEAN 15 FEB 073

V. GEOMAGNETIC A INDICES
OBSERVED - AVE/AP 14 FEB 016/013
ESTIMATED AVE/AP 15 FEB 007/010
PREDICTED AVE/AP 16 FEB-18 FEB 010/010-015/010-015/015

VI. GEOMAGNETIC ACTIVITY PROBABILITIES 16 FEB-18 FEB

A. MIDDLE LATITUDES

ACTIVE	15/25/25
MINOR STORM	10/15/15
MAJOR-SEVERE STORM	01/05/05

B. HIGH LATITUDES

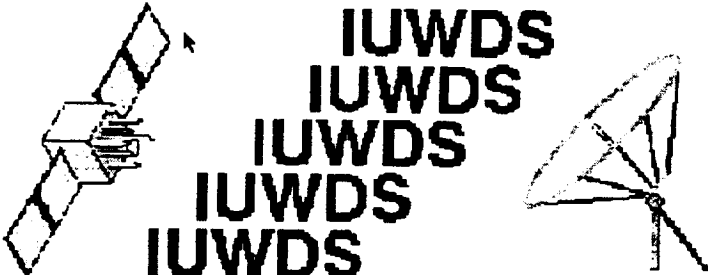
ACTIVE	15/25/25
MINOR STORM	10/15/15
MAJOR-SEVERE STORM	01/05/05

Netscape: The World Space Weather Service (IUWDS)

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.sel.bldrdoc.gov/iuwds/overview.html>

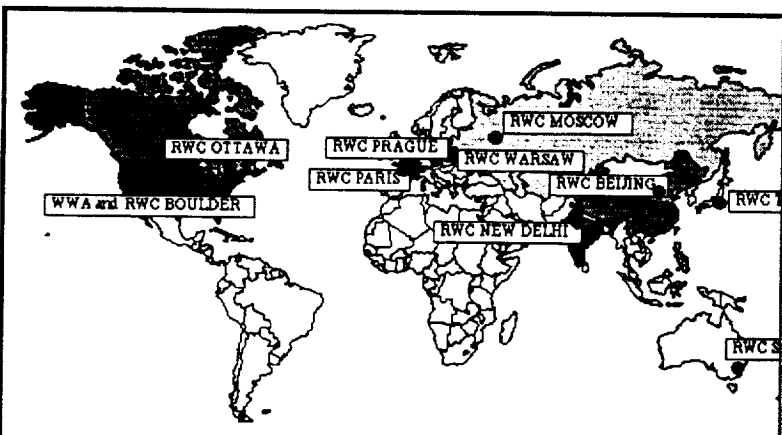
What's New? What's Cool? Handbook Hot Search Hot Directory Newsgroups



**IUWDS
IUWDS
IUWDS
IUWDS
IUWDS**

The World Space Weather Service (IUWDS)

The International Unigram and World Days Service (IUWDS) is a joint service of URSI, IAU and IUGG and is a permanent service of the Federation of Astronomical and Geophysical Data Services (FAGS). During its existence IUWDS has had an important role in co-ordinating the exchange of data between organisations around the world who are involved in forecasting solar terrestrial conditions. These centres, known as Regional Warning Centres (RWCs), have the responsibility for collecting data from their geographical areas and exchanging these data through the IUWDS network.



Information on the nature of and services provided by the World Space Weather Service can be found at this site. The world's real-time space weather services are provided by ten Regional Warning Centers (RWC's) listed within this site. These centers are responsible for monitoring solar conditions and predicting solar-terrestrial activity.

At present, there are ten Regional Warning Centres scattered around the globe. These centres are located in Beijing (China), Boulder (USA), Moscow (Russia), Paris (France), New Delhi (India), Ottawa (Canada), Prague (Czech Republic), Tokyo (Japan), Sydney (Australia) and Warsaw (Poland). A data exchange schedule operates with each centre providing and relaying data to the other centres. The centre in Boulder plays a special role as "World Warning Agency", acting as a hub for data exchange and forecasts.

The data exchanged are highly varied in nature and in format, ranging from simple forecasts or coded information up to more complicated information such as images. An important strength of the data exchange system is that RWCs often have access to data from unique instrumentation available from the scientific community in its region. Exchange through IUWDS makes these data available to the wider international scientific and user community. The prime reason for the existence of the Regional Warning Centres is to provide services to the scientific and user communities within their own regions. These services usually consist of forecasts or warnings of disturbances to the solar terrestrial environment. The range of the locations of RWCs results in a very large diversity in the users of these forecasts. An important feature of the IUWDS system is that RWCs are able to construct and direct their services to the specific needs of their own customers.

Users of the services of RWCs include: high frequency (HF) radio communicators; mineral surveyors using geophysical techniques; power line and pipeline authorities; operators of satellites and a host of commercial and scientific users. The increasing sophistication and sensitivity of modern technology has resulted in a steadily expanding range of applications where a knowledge of the solar terrestrial environment is important.

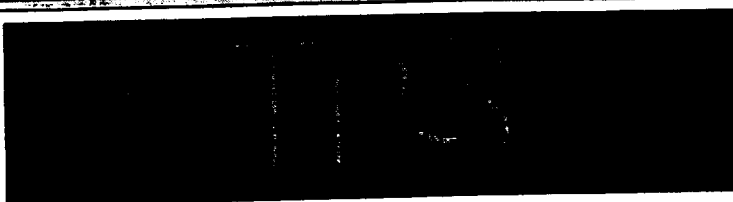

<http://www.sel.bldrdoc.gov/iuwds/overview.html>

Netscape: IPS Home Page

Back Forward Home Reload Images Open Print Find Stop

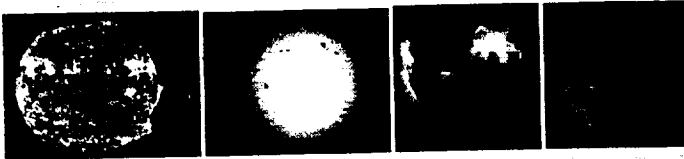
Location: <http://www.ips.oz.au/>

What's New? What's Cool? Handbook Net Search Net Directories Software

Reality Check: Local time now is 1427 hrs, 18 Feb 1996 [0327 hrs, 18 Feb 1996 UT]
If this is not correct, click RELOAD now.

Welcome to the IPS Radio & Space Services WWW server.



IPS is a unit of the Australian Government Department of Administrative Services and provides the Australian radio propagation and space environment services.

Web site of the Sydney, Australia Regional Warning Center. provides a long list of services for commercial and other users whose activities make them vulnerable to space weather effects. Contained in this site is an extensive library of space weather information including web pages detailing the impacts of space weather events on technologies.

<http://www.ips.oz.au/>

Netscape: IPS Sydney RWC - Current Solar-Terrestrial Environment

Back Forward Home Reload Images Open Print Find Stop

Location: <http://www.ips.oz.au/rwc/current/index.html#solobs>

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IPS

Radio & Space Services

Sydney Regional Warning Centre
Current Australian Region Solar-Terrestrial Environment

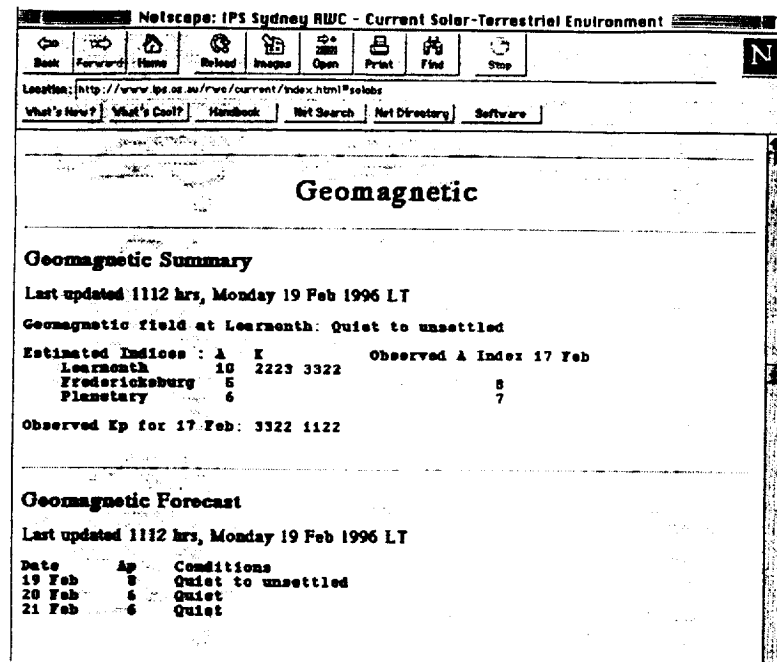
Last updated: 1112 hrs, Monday 19 Feb 1996 LT

Reality Check: Local time now is 1417 hrs, 19 Feb 1996 [0317 hrs, 19 Feb 1996 UT]
If this is not correct, click RELOAD now.

Table of Contents

- Ionosphere
 - Australian Region Ionospheric Summary
 - Australian Region Ionospheric Forecast
 - Plot of Australian f_oF₂ Ionospheric Values
- Geomagnetic
 - Geomagnetic Summary
 - Geomagnetic Forecast
 - Plot of Longmuth Magnetometer Data

<http://www.ips.oz.au/rwc/current/index.html#solobs>



Geomagnetic activity forecast.

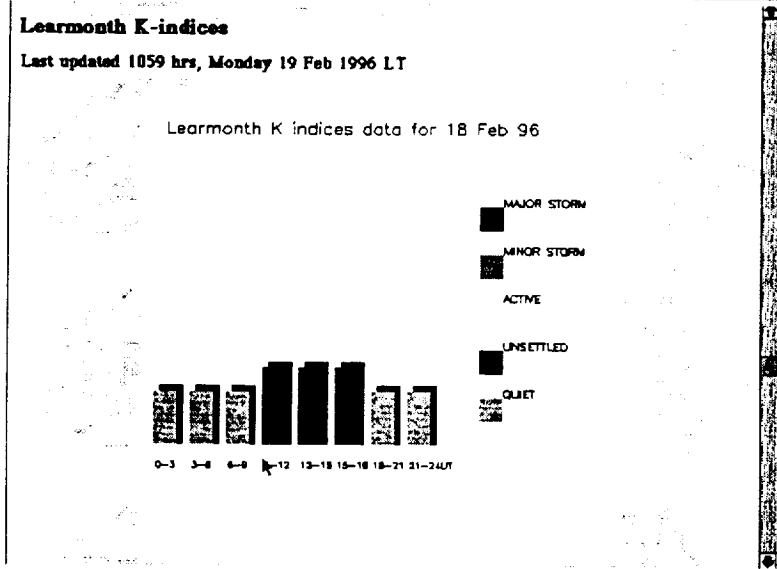
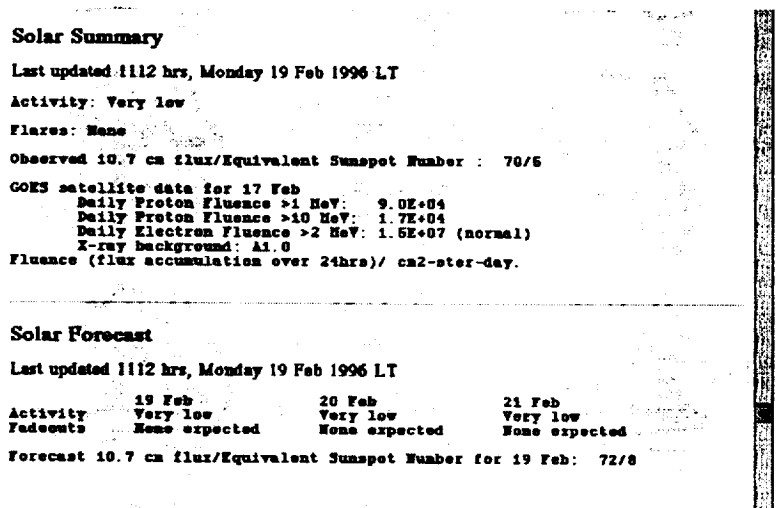


Illustration of the range of values of the K-index associated with difference levels of magnetic activity.



Solar activity forecast.

<http://www.ips.oz.au/rwc/current/index.html#solobs>


Navigation icons: Back, Forward, Home, Reload, Images, Open, Print, Find, Stop

Location: <http://hiraiso.crl.go.jp/>

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Hiraiso Solar Terrestrial Research Center/CRE

Space Environment Information Service for the Internet



NOTE: that this is a real-time/near real-time data service, and the data is updated continuously on daily basis. However, the service is still experimental, so we cannot guarantee its full functionality. Any comments on our services are appreciated. To find out more what our organization is, click [here](#).

Solar-Terrestrial Predictions Workshop 1996(STPW'96) Information

- What is the STPW?
- First Announcement
- Second Announcement
- General Information on STPW'96 and SFRD
- STPW'96 & SFRD Schedule

Space Environment Information

- Glossary of Solar-Terrestrial Terms
- International Ultraviolet and World Data Service(IUWDS)
- Space Weather Telephone Service
- Space Environment Realtime Data Intercommunication Network(SERDIN)
- INTERMAGNET
- Hiraiso Radio Spectrometry(HIRAS)
- Solar Activity Chart
- Geomagnetic K-Indices
- GMS-4/SEM High Energy Particle Flux

Hiraiso/CRL Anonymous FTP Sites

- H-alpha solar image(Experimental)
- Solar Radio Spectra(Experimental)

World Data Center(WDC) C2 for Ionosphere

- Introduction of WDC-C2 for Ionosphere
- Digital Ionograms by Ionospheric Sounding Data Network(IONET)(Experimental)
- CRL Ionospheric Observations

Related WWW Sites

- The World Space Weather Service(IUWDS)
- Space Environment Center(SEC)
- Prediction 10cm Solar Radio Flux
- Solar Data Analysis Center(SDAC) at NASA Goddard Space Flight Center
- NASA Information Services via World Wide Web
- Geospace Environment Modeling(GEM) Homepage
- Communications Research Laboratory(CRL) Home Page
- Physics Service and Services around the World
- IPS Radio & Space Services, Australia
- Solar Terrestrial Physics Division at NGSC
- Rice University's Space Weather Program
- Kiruna magnetometer, Swedish Institute of Space Physics
- Rik Bear Solar Observatory
- National Space Development Agency(NASDA) of Japan Home Page

Real-time and near real-time data service for solar, magnetospheric and ionospheric measurements.

<http://hiraiso.crl.go.jp/>

Geophysical Institute Auroral Activity Forecast

Weekly predictions about auroral activity over Alaska (and the northern hemisphere) will be available here while the nights are dark enough to observe aurora.

- [This week's forecast](#)
- [The previous forecast](#)

The predictions, which are forecast by Geophysical Institute Director Syun Akasofu and Poker Flat Research Range Scientific Director Charles Deehr, are made on the basis of solar activity as measured by its effects on the earth's magnetic field. [Geomagnetic activity plots](#) and some [notes on interpreting these forecasts](#) are available.

Information about the earth's magnetic field is obtained from a worldwide network of instruments accessible via computer through the Internet by Geophysical Institute Programmer Analyst Li-hor Lee. That information is combined with data from previous solar rotations for the forecast.

Predictions of auroral activity are possible this year because the active regions of the sun are at the low end of the 11-year cycle. That cycle of solar activity is characterized by erratic bursts of solar flares at the high end of the cycle and relatively stable solar activity at the low end.

Active regions on the sun create an electrically charged wind which blows through the solar system, and is pulled close to the earth in rings around the north and south geomagnetic poles, creating the aurora.

Hot spots of solar activity face the earth every 28 days, as the sun rotates on its axis. The intensity of the solar wind created as a result can be measured by its effect on the earth's magnetic field.

For More Information...

- [Some general information](#) about the aurora.
- [The Auroral Color Television Project](#) videos.
- [Poker Flat Research Range](#): auroral research and recent auroral animations.
- [Geophysical Institute](#): Scientific research into the earth, sky, and space.
- [Today's Space Weather](#) from the Space Environment Center in Boulder, Colorado.
- [The Aurora Page](#) from Michigan Technological University.
- [The Northern Lights Planetarium](#): Information about the aurora and Norway's first public planetarium.
- [Auroral Large Image System \(ALIS\)](#): recent images from Sweden.

Predictions of the location and extent of auroral activity.

<http://dac3.gi.alaska.edu/~pfr/AURORA/INDEX.HTM>

Geophysical Institute Auroral Activity Forecast Notes

The [weekly auroral activity forecast](#) gives a general idea of the level of geomagnetic activity that can be expected for the given period. Aurora viewing is also affected by a variety of other factors, such as cloud cover, moonlight, and urban light pollution, so what you see will be strongly affected by your particular location and meteorological luck.

The best time to observe aurora is near local midnight, when the most active forms often occur. More precisely, the time to shoot for is an hour or two prior to local geomagnetic midnight, and the forecast maps found here are calculated for that time. If you are a serious aurora watcher, plan to spend the night from about 10 P.M. to 2 A.M. watching for auroral action.

Auroral activity tends to come in waves during an evening, which are called geomagnetic substorms. Even during an active period, there will be lulls in which the auroral activity is subdued; however, the patient observer will often see a new burst of activity within an hour or two.

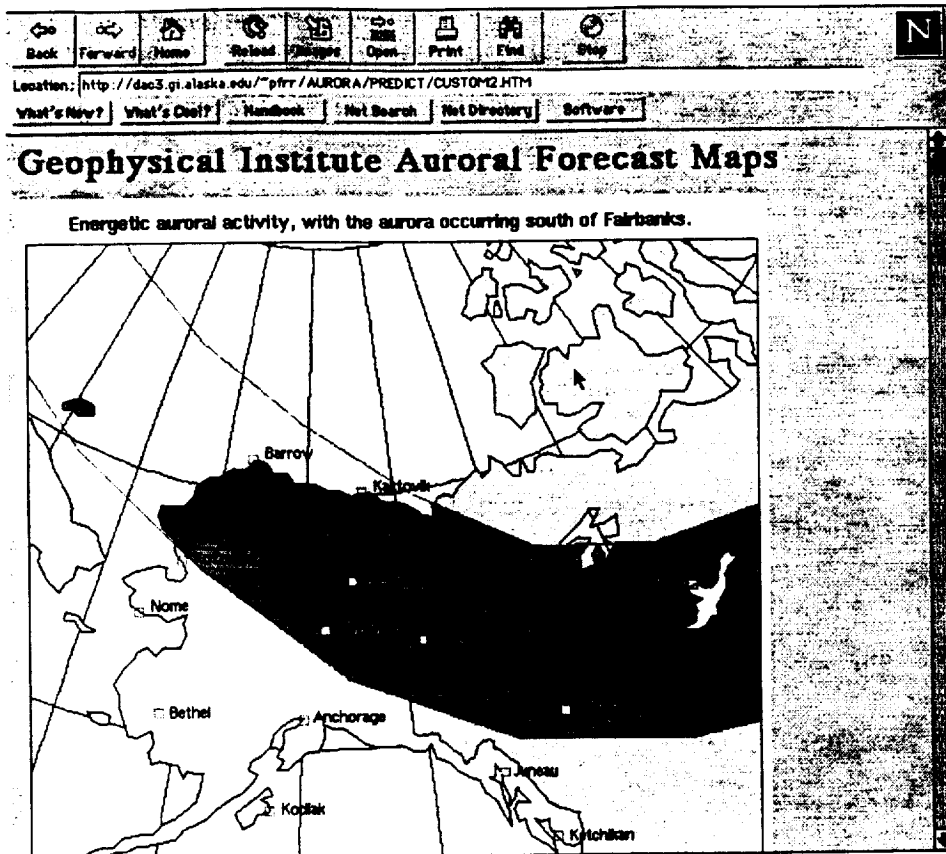
The auroral forecasts categorize auroral activity as follows:

- [Minimum](#)
- [Quiet](#)
- [Moderate](#)
- [Active](#)
- [High](#)
- [Maximum](#)

The forecasts deal with the average level of activity expected within the prediction period. The sun occasionally produces bursts of unforeseen intensity, so some of the most spectacular auroral displays can come with little warning.

For more information on the aurora, consult *The Aurora Watcher's Handbook* by Neil Davis (ISBN 0-912006-60-9).

<http://dac3.gi.alaska.edu/~pfr/AURORA/NOTES.HTM>



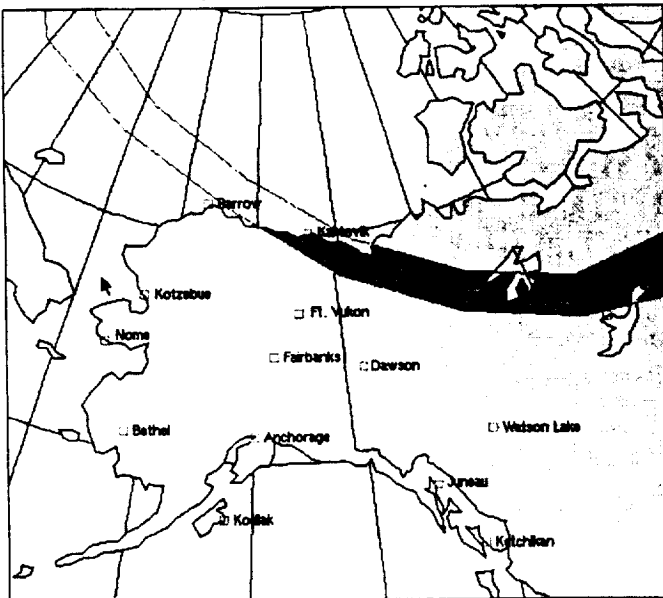
Comparison between the predicted auroral oval and statistical auroral ovals for various activity levels provides a dramatic indicator of the current level of magnetic activity.

<http://dac3.gi.alaska.edu/~pfrr/AURORA/PREDICT/CUSTOM2.HTM>

Statistical Auroral Oval Maps

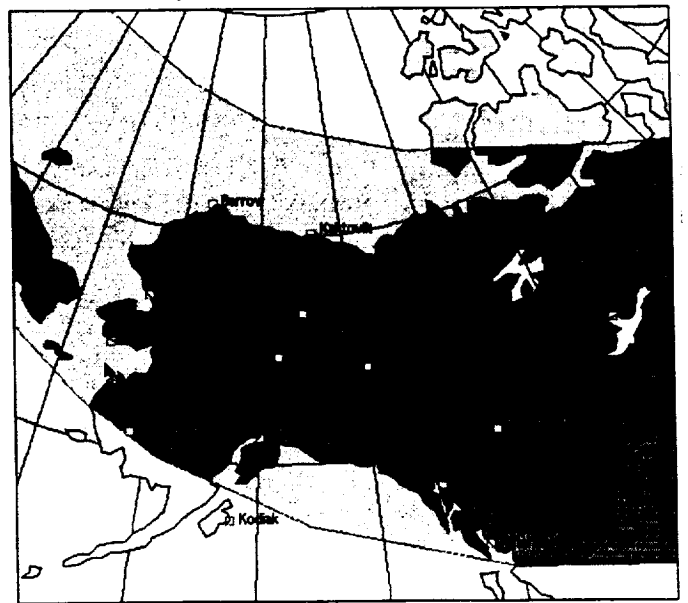
Low Magnetic Activity

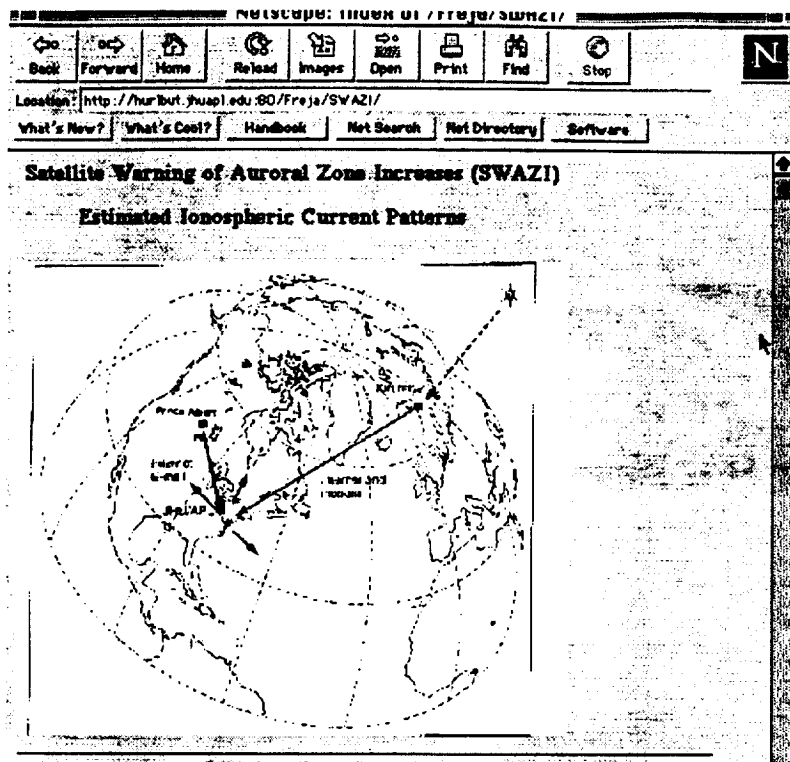
Minimum auroral activity, with aurora occurring mainly north of the Arctic Coast.



High Magnetic Activity

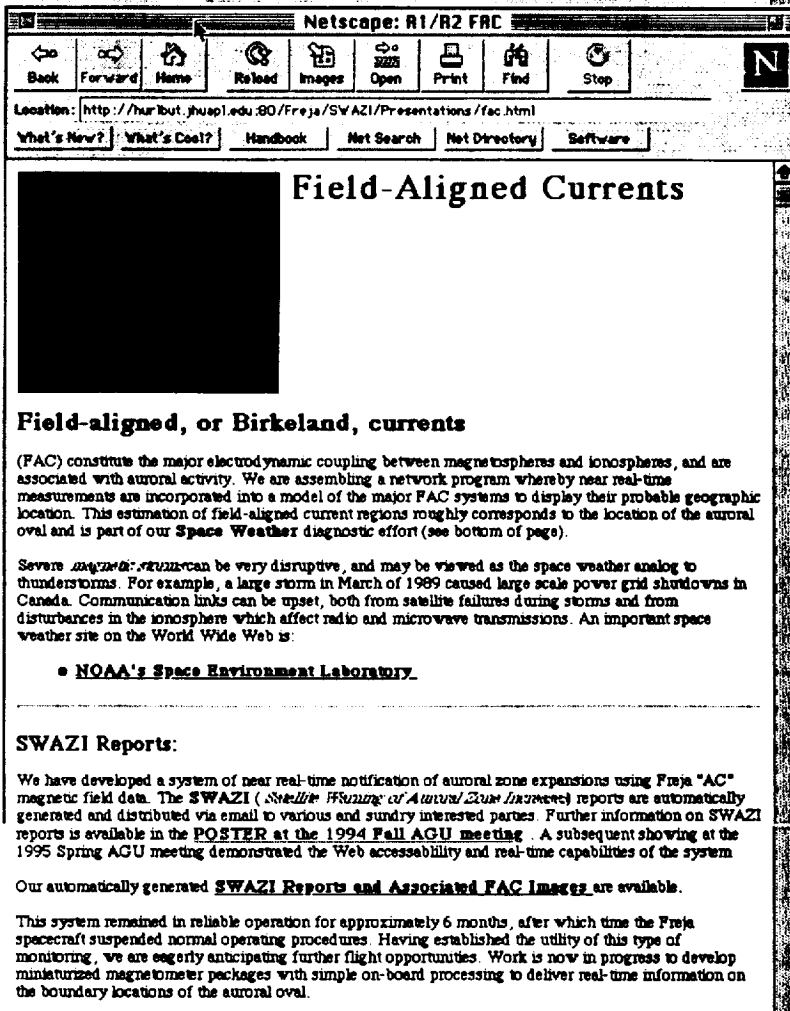
Maximum activity, with the aurora visible over most of the northern U.S.





Field tested method for predicting the location and extent of the auroral oval. Description of the method given along with examples of its past use.

<http://hurlbut.jhuapl.edu:80/Freja/SWAZI/>




<http://hurlbut.jhuapl.edu:80/Freja/SWAZI/Presentations/fac.html>

Netscape: Radio Users' Page

Location: <http://www.sel.bldrdoc.gov/radio/radio.html>

Space Environment Center

Radio User's Page



PURPOSE: To provide radio operators with current data on the state of the ionosphere.

Space Environment Center, (SEC), provides you with a [glossary](#) of space environment terms.

Today's Space Weather

Current Space Environment Reports

One major impact of geomagnetic activity is disruption of radio communications. On this page are forecasting sites for radio users. More are contained in the IPS web pages (see page 33 in this guide).

<http://www.sel.bldrdoc.gov/radio/radio.html>

Netscape: Near-Real-Time MUF Map

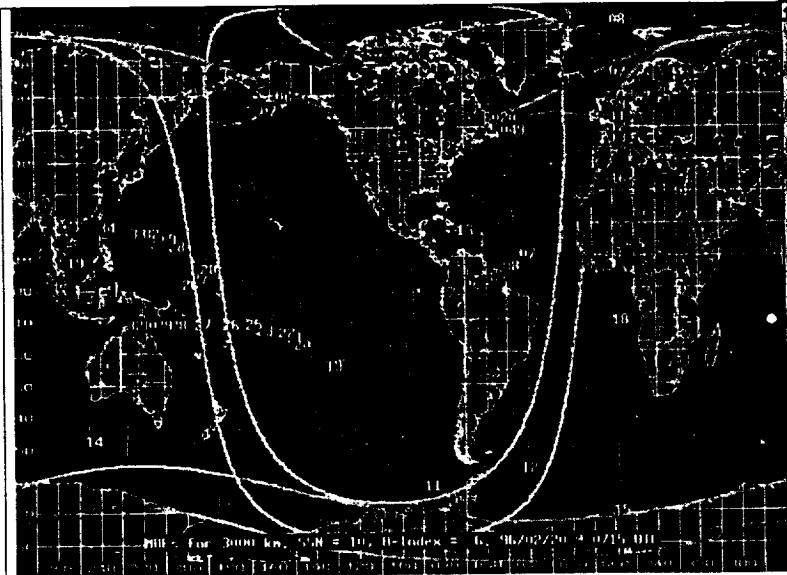
Location: <http://solar.uleth.ca/solar/www/realtime.html>

Near-Real-Time MUF Map

Warning: Space Weather and Radio Propagation Forecasting Course. It's a GO! Sign up now for the 18 March scheduled start-date for this course, or forever hold your peace.

The following image is a recent high-resolution map of Maximum Usable Frequencies (MUFs) for 3,000 kilometer radio signal paths. It is also a map showing the current location of the auroral ovals, the sunrise/sunset terminator and the regions of the world where the sun is 12 degrees below the horizon (which estimates the gray-line corridor where HF propagation is usually enhanced). This is one of a plethora of constructable maps that is produced by *SKYCON PRO Version 2.0*, a very powerful radio propagation software package for IBM or compatible computers, ideal for amateur or professional radio communications. Instructions on how to use this map follow below.

(This map is updated every hour.)

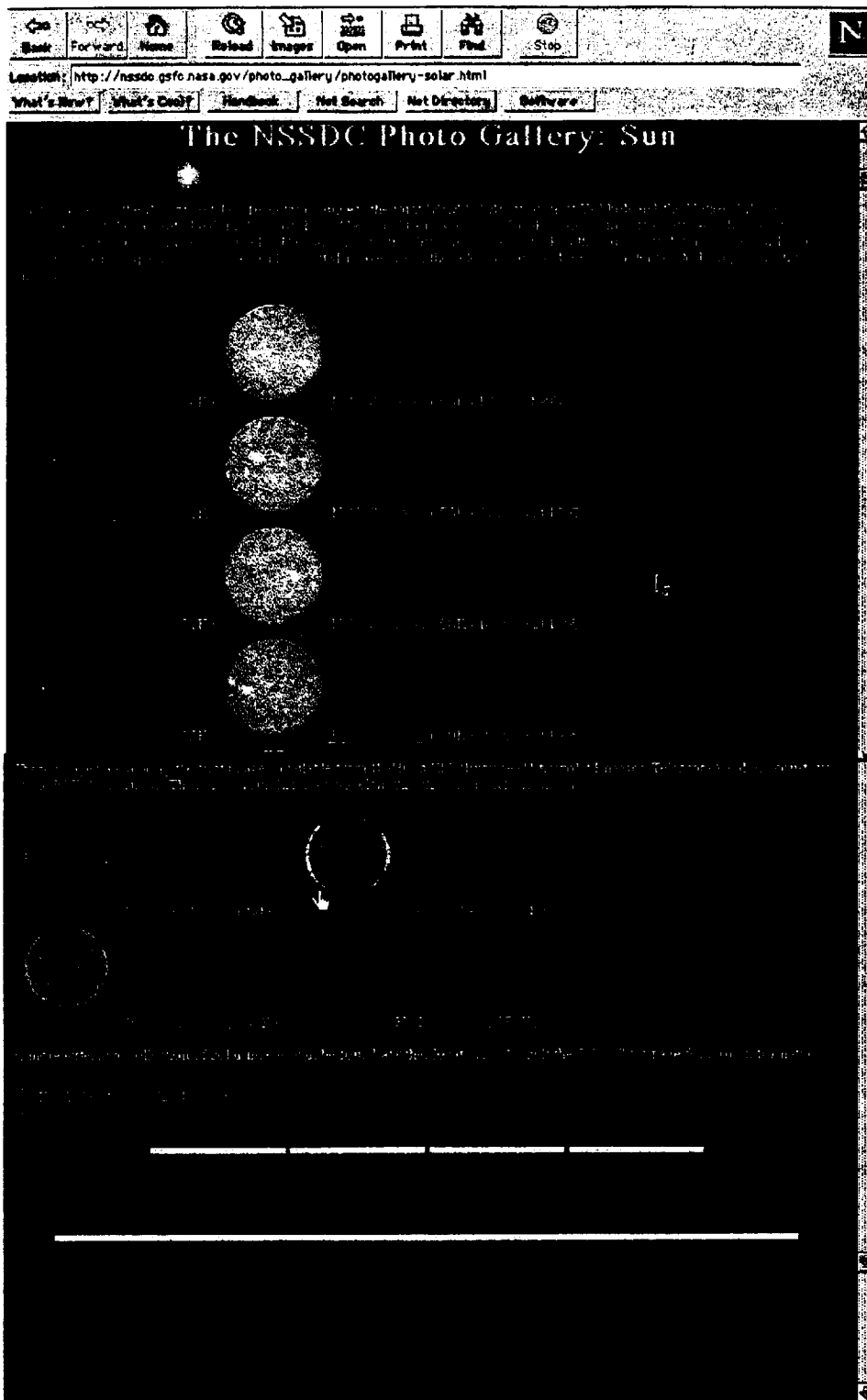


MUF: For 3000 km, M3000 = 10.0, H-findex = 0.9, 98/02/20 07:15:00

<http://solar.uleth.ca/solar/www/realtime.html>

Space Physics Data Bases and Photo Galleries of Space Physics-Related Images

The web is fast becoming the most popular means of freely and easily accessing NASA's immense photographic galleries of celestial objects, the sun, planets and other solar system bodies as well as the photographic holdings of other agencies, universities, national observatories and international centers.



Without a doubt, the NSSDC Photo Gallery is one of the most beautiful sites on the web. This subpage contains links to hundreds of images of the sun. The home page of the NSSDC gallery also contains links to images of the planets, stars and galaxies

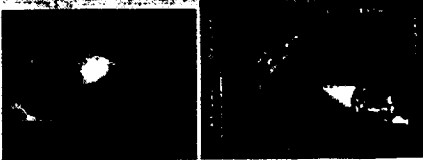
[http://nssdc.gsfc.nasa.gov/
photo_gallery/
photogallery-solar.html](http://nssdc.gsfc.nasa.gov/photo_gallery/photogallery-solar.html)

NEWSGROUP: SOLAR HOME PAGE

Location: <http://umbra.nascom.nasa.gov/sdac.html>

What's New? What's Cool? Handbook X-1000 Net Search Net Directory Software

The SPARTAN 201-03 Mission



Data from the first three orbits of the SPARTAN 201-03 flight on 1995 September 8 have been informationed: a new image is shown on the left. "The best data ever from an orbiting, externally occulted coronagraph," according to the modest statement of the Principal Investigator.

SPARTAN 201-3 was deployed on schedule at 10:41 AM CDT, Friday, 1995 September 8, and was retrieved at 10:20 AM CDT, Sunday, 1995 September 10. STS-69 landed at 6:38 AM CDT, Monday, 1995 September 18.

More information on the SPARTAN 201 hardware, flight, and scientific objectives is available.

Future solar missions

Information on proposed and approved solar missions and solar mission programs, including:

- TRACE
- The Solar-B Mission concept
- HIN
- The Solar Connection program

Links provided to images of the corona and the solar wind from the SPARTAN 201-3 data base.

<http://umbra.nascom.nasa.gov/sdac.html>

NEWSGROUP: SPARTAN 201-3

Location: <http://umbra.nascom.nasa.gov/spartan/>

What's New? What's Cool? Handbook Net Search Net Directory Software



SPARTAN 201: NASA's mission to explore the Sun's corona

A composite image of the solar corona on 1995 April 11 from SPARTAN 201: White Light Coronagraph (foreground), the High Altitude Observatory Mk. III coronagraph on Mount Lee, Shred (middle), and the Tuller Soft X-Ray Telescope (innermost image).

Navigation panel for the Spartan 201-3 web site.

<http://umbra.nascom.nasa.gov/spartan/>

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Location: http://nssdc.gsfc.nasa.gov/space/space_physics_home.html

What's New? What's Cool? Handbook Net Search Net Directory Software

SPACE PHYSICS

AT THE NATIONAL SPACE SCIENCE DATA CENTER

Space physics data occupy a significant portion of NSSDC's archives. Much of NSSDC's most popular NASA space physics data is accessible electronically through NSSDC's near-line data system (NDADS) and various on-line services (e.g., OMNIWeb). NSSDC also archives and distributes a number of space physics CD-ROMs and models. Those interested in reading about data available from, and other aspects of, currently important NASA space physics missions should browse through the [Flight Physics](#) section on this page.

NSSDC is a partner of the Space Physics Data Facility, within Goddard's Space Science Data Operations Office, in archiving public data and services to the NASA and more general space physics communities.

What's New

- [IRI and MMS model densities and temperatures on the WWW](#)
- [ISTP Key Parameter Data Released for Public Use](#)
- [SP-CAT missed!](#)
- [Heliospheric Enhancements for Selected Spacecraft and Planets](#)
- [IMP-8 Position Information](#)

NSSDC Resources

Data Display/Retrieval

- [OMNIWeb](#) (Browse and retrieve OMNI data)
- [COHOWeb](#) (Browse and retrieve COHO data)
- [SP-CAT](#) (Retrieve Space Physics data from NDADS)
- [NSSDC CD-ROM Catalog](#)
- [NSSDC anonymous FTP site](#)

Information Services

- [NASA Master Directory](#) High level descriptions of data held at NSSDC and elsewhere
- [NSSDC Master Catalog](#) Detailed information about data held at NSSDC
- [NSSDC WAIS Search](#) - Searchable WAIS Index of NSSDC's Web pages
- [Space Physics Models at NSSDC](#)
- [Corrected Geomagnetic Coordinates and Related Parameters](#)
- [Coordinated Data Analysis Workshops \(CDAW\)](#)
- [Satellite Simulation Center \(SSC\)](#)
- [Heliospheric Enhancements for Selected Spacecraft and Planets](#)

Access to the nation's treasure trove of archived satellite data related to space physics through the NSSDC.

http://nssdc.gsfc.nasa.gov/space/space_physics_home.html

Flight Projects

Current and Past

- ▲ **Aurora** (Joint Canadian-U.S. mission to study the Earth's ionosphere)
- ▲ **Aurora** (ESA/ESA/NASA mission to study the Earth's ionosphere and thermosphere)
- ▲ **ACE** (Joint NASA/ESA/ESA mission to study the magnetospheric transport properties)
- ▲ **CHAMP** (Joint US/ESA/NASA mission to study magnetospheric transport)
- ▲ **Exospheric Explorer** (NASA mission to study the Earth's lower magnetosphere, ionosphere, and upper atmosphere)
- ▲ **Foto** (Swedish/ESA mission to study the Earth's magnetosphere and aurora)
- ▲ **Global** (Joint ESA/NASA/ISTP Mission to study the geomagnetic field)
- ▲ **HiView** (NASA Explorer Mission to study the Earth's magnetosphere)
- ▲ **IMP-8** (NASA Explorer Mission to study the solar wind and the Earth's magnetosphere)
- ▲ **Interball** (Russian ISTP Mission to study the Earth's magnetosphere, ionosphere, and aurora)
- ▲ **IRIS** (NASA Explorer Mission to study the solar wind and the Earth's magnetosphere)
- ▲ **ISEE** (Joint Canadian-U.S. mission to study the Earth's ionosphere)
- ▲ **ISTP** (International Solar-Terrestrial Physics Program)
- ▲ **SAMPEX** (NASA mission to study the Earth's magnetosphere, solar wind, and cosmic rays)
- ▲ **Solar Wind** (Joint Italian-NASA mission to study solar activity and thermosphere-ionosphere phenomena)
- ▲ **TRE-1** (Joint Italian-NASA mission to study the interaction between a water system and ambient space plasma)
- ▲ **Ulysses** (Joint ESA/NASA mission to study the Sun and solar wind at high latitudes)
- ▲ **YF90** (Swedish mission to study the Earth's magnetosphere and aurora)
- ▲ **Wind** (NASA ISTP Mission to study the solar wind)

Future

- ▲ **ACE** (NASA mission to study particles of solar, interplanetary, interstellar, and galactic origin)
- ▲ **Chorus** (ESA/ISTP Mission to study the Earth's magnetospheric environment)
- ▲ **FAST** (NASA mission to study aurora)
- ▲ **Polar** (NASA ISTP Mission to study Earth aurora and high-latitude magnetospheric phenomena)
- ▲ **TIMED** (NASA mission to study the Earth's thermosphere, mesosphere, and ionosphere)
- ▲ **TRE-1B** (Joint Italian-NASA mission to study the interaction between a water system and ambient space plasma)

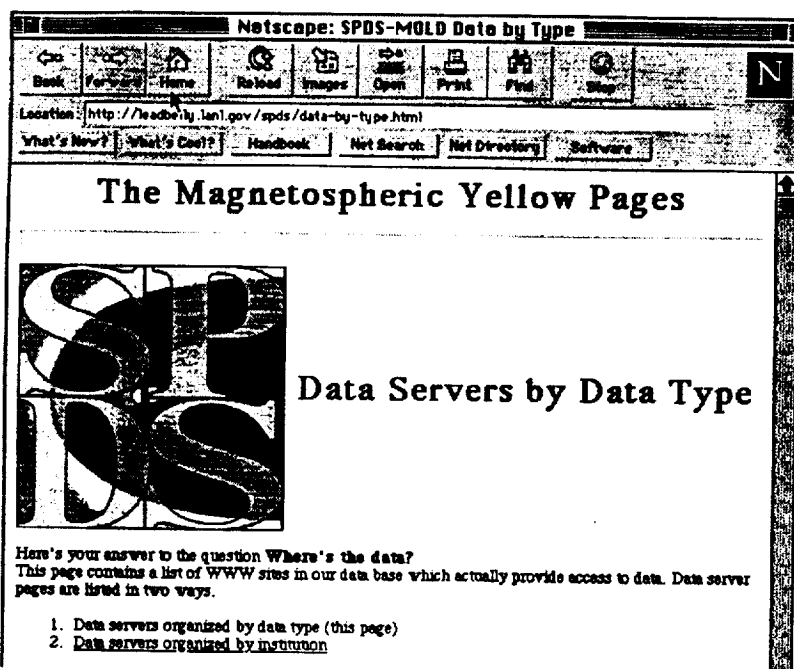
Planetary of Interest

- ▲ **Cassini** (NASA Mission to study Venus, Earth, Jupiter, Saturn, and the intervening interplanetary medium)
- ▲ **Galileo** (NASA Mission to study Venus, Earth, Jupiter, and the intervening interplanetary medium)
- ▲ **Pioneer 10/11** (NASA Mission to study Jupiter, Saturn, the interplanetary medium, and beyond)
- ▲ **Pioneer Venus** (NASA Mission to study Venus and the neighboring interplanetary medium)
- ▲ **Voyager** (NASA Mission to study the gas giant planets, the interplanetary medium, and beyond)

Other Resources

- ▲ **Space Physics Data Facility**
- ▲ **Space Physics Data System**
- ▲ **Solar-Terrestrial Energy Program (STEP)**
- ▲ **NASA HQ Space Physics Division**
- ▲ **National Geophysical Data Center (NGDC) Solar-Terrestrial Data**
- ▲ **American Geophysical Union (AGU)**
- ▲ **1995 ITM MOWO Findings**
- ▲ **Go to the NSSDC Home Page**

http://nssdc.gsfc.nasa.gov/space/space_physics_home.html



Comprehensive listing of archived space physics data sets by Institution and type of data. Contains helpful descriptions of the resources available at the sites in the reference list to help you to decide which sites to visit.

AMPTE

- SVRI Data Display and Analysis System (SDDAS)
Delivery, display and analysis of data from missions including experiments on Dynamics Explorers 1/2 (DE 1/2), UARS, AMPTE, ARIA, TSS-1 and CRRES (LOMICS).
- Mullard Space Science Lab Missions
MSSL space plasma physics group. Contains access to data from the AMPTE, Giotto, CRRES, Pegasus, Meteosat 3, and STV missions. The interface is an excellent one and the range of information on some of these missions is unusually complete. Pages for individual missions include access to plots and data.
- University of Iowa Space Physics Data Center (UI-SPDC)
Selection, ordering, and display of wideband analog data from ISEE 1 & 2, Dynamics Explorer 1, Spacelab 2 PDP, Hawkseye, SSS-A AMPTE, IMP 6, and Injun 5. Associated with the outer planets subnode of the Planetary Plasma Interactions node of the Planetary Data System (PDS-PPI).

CCE

- AMPTE/CCE Science Data Center
Delivery, display and analysis of data from the Active Magnetospheric Particle Tracing Explorer/Charge Composition Experiment (AMPTE/CCE) and from related spacecraft such as GOES, IMP, TRIAD and others.
- Coordinated Data Analysis Workshop (CDAW)
Information on the CDAW campaigns, data intervals, and data availability along with what access to the CDAW database.

IRM

- Coordinated Data Analysis Workshop (CDAW)
Information on the CDAW campaigns, data intervals, and data availability along with what access to the CDAW database.

<http://leadbelly.lanl.gov/spds/data-by-type.html>

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Location: http://nssdc.gsfc.nasa.gov/solar/solar_home.html

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SOLAR

AT THE NATIONAL SPACE SCIENCE DATA CENTER

Solar physics data covers a sizable portion of NSSDC's archives. Much of NSSDC's most popular NASA solar physics data are accessible electronically through NSSDC's near-line data system (NDADE). Those interested in finding about data available from, and other aspects of, currently important NASA space physics missions should browse through the [Flight Projects](#) section on this page.

NSSDC is a partner of the Space Physics Data Facility, within Goddard's Space Science Data Operations Office, in bringing public data and services to the NASA and more general solar physics communities.

NSSDC Resources

Data Display/Retrieval

- [Solar Physics Data on NDADE](#)
- [Example Solar Data](#)
- [Image Data](#)
- [NSSDC Photo Gallery](#)

Information Services

- [NASA Mission Directory](#) High level descriptions of data held at NSSDC and elsewhere
- [NSSDC Master Catalog](#) Detailed information about data held at NSSDC
- [NSSDC WAIS Search](#) - Searchable WAIS Index of NSSDC's Web pages

Flight Projects

Current and Past

- [Storvik \(NASA\)](#)
- [SOHO \(Joint NASA/ESA/ISTP mission\)](#)
- [Solar Maximum Mission \(NASA\)](#)
- [Suzero 201 \(NASA\)](#)
- [Yohkoh \(Joint ISAS/NASA/ISTP mission\)](#)

Other Resources

- [Space Physics Data Facility](#)
- [Space Physics Data System](#)
- [Solar Data Analysis Center](#)
- [National Solar Observatory](#)
- [NOAA Space Environment Laboratory](#)
- [NASA HQ Space Physics Division](#)

- [Go to the NSSDC Home Page](#)
- [Go to the GSFC Home Page](#)
- [Go to the NASA Home Page](#)

*For questions about Solar data at the NSSDC, please contact:
 Dr. David A. Burchette, burchette@nssdc.gsfc.nasa.gov, (301) 286-2500
 Space Physics Data Facility, Code 632, NASA/Goddard Space Flight Center
 Greenbelt, MD 20770 USA*

Easy access to the nation's vast storehouse of solar physics data bases held at the NSSDC.

http://nssdc.gsfc.nasa.gov/solar/solar_home.html

Collected images of the Sun in different wavelengths of light.

<http://orpheus.nascom.nasa.gov/synoptic/>

Location: <http://orpheus.nascom.nasa.gov/synoptic/>
What's New? What's Cool? Handbook Net Search Net Directory Software

SOHO Synoptic Database

Welcome to the SOHO Synoptic Database, part of the SOHO Data Archive.
Mechanical in the SOHO Synoptic Database are daily solar synoptic images from various ground-based solar observatories and from the SOHO spacecraft. Please note that these images have not necessarily been corrected for instrumental effects and are provided courtesy of the original institution. One of the purposes of this database, together with the SOHO Summary Database, is to provide a mechanism to the SOHO-PI teams for communicating planning activities at the SOHO RAP/ROP located at GSFC and the input to the daily planning meetings. Daily operations schedule is made at such planning meetings.
All solar images archived in the SOHO Synoptic Database can be queried through the SOHO Online Synoptic Database Search Facility. The most recent solar images for a given date can be viewed through the appropriate highlighted data below.

- February 15, 1996
- February 14, 1996
- February 13, 1996
- February 12, 1996
- February 11, 1996
- February 10, 1996

Solar Images Obtained Before February 02, 1996

Solar images are available for the following dates:

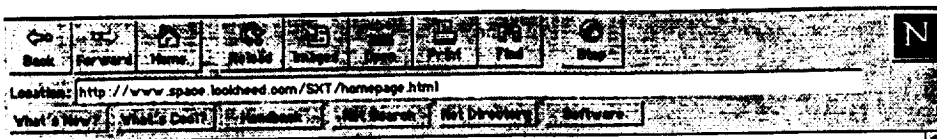
- February 1, 1996
- January 30, 1996
- January 29, 1996
- January 28, 1996
- January 27, 1996
- January 26, 1996
- January 25, 1996
- January 24, 1996

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Location: http://orpheus.nascom.nasa.gov/cgi-bin/query_image/951214
What's New? What's Cool? Handbook Net Search Net Directory Software

CSFC Time: 96/02/16 04:21 UT: 96/02/16 09:21

The following data are available for December 14, 1995:



YOHKOH SXT



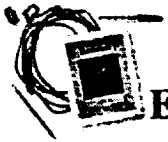
An X-ray picture of the sun taken with the Soft X-Ray Telescope (SXT) onboard the orbiting Yohkoh satellite



IMAGES



CURRENT
OPERATIONS



EXTRAS



IN PROGRESS

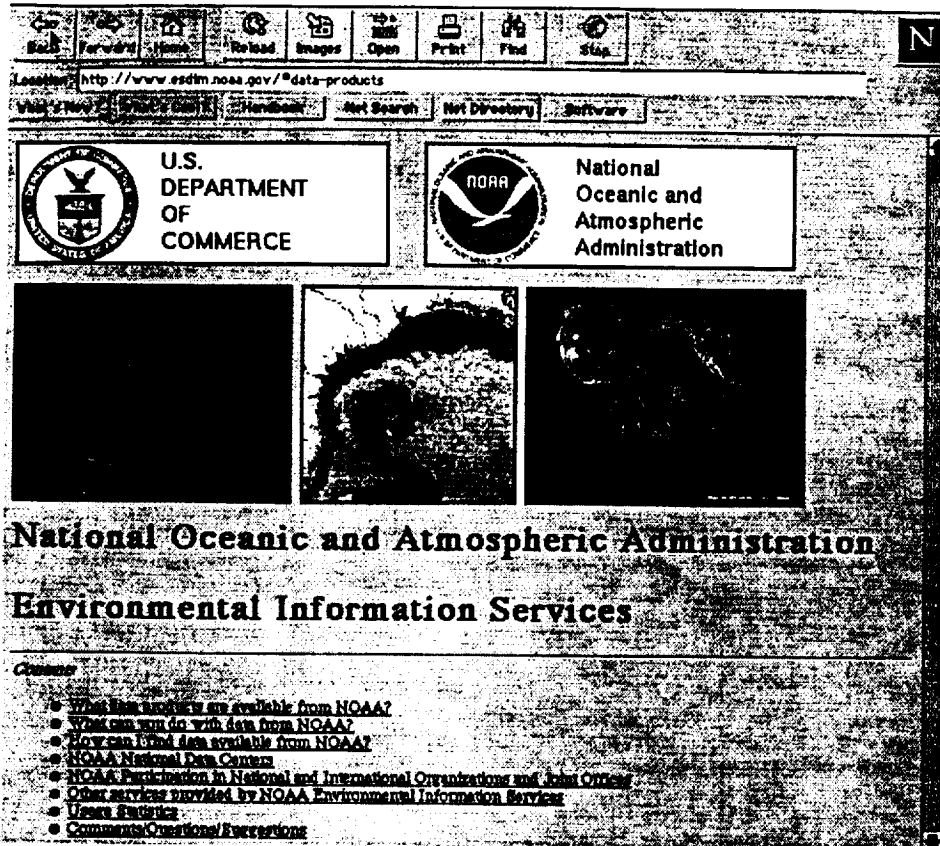


SOLAR WEB
GUIDE

[Recent SXT Images w/NOAA AR](#) [Recent SXT Images](#) [First Light Mosaic](#)

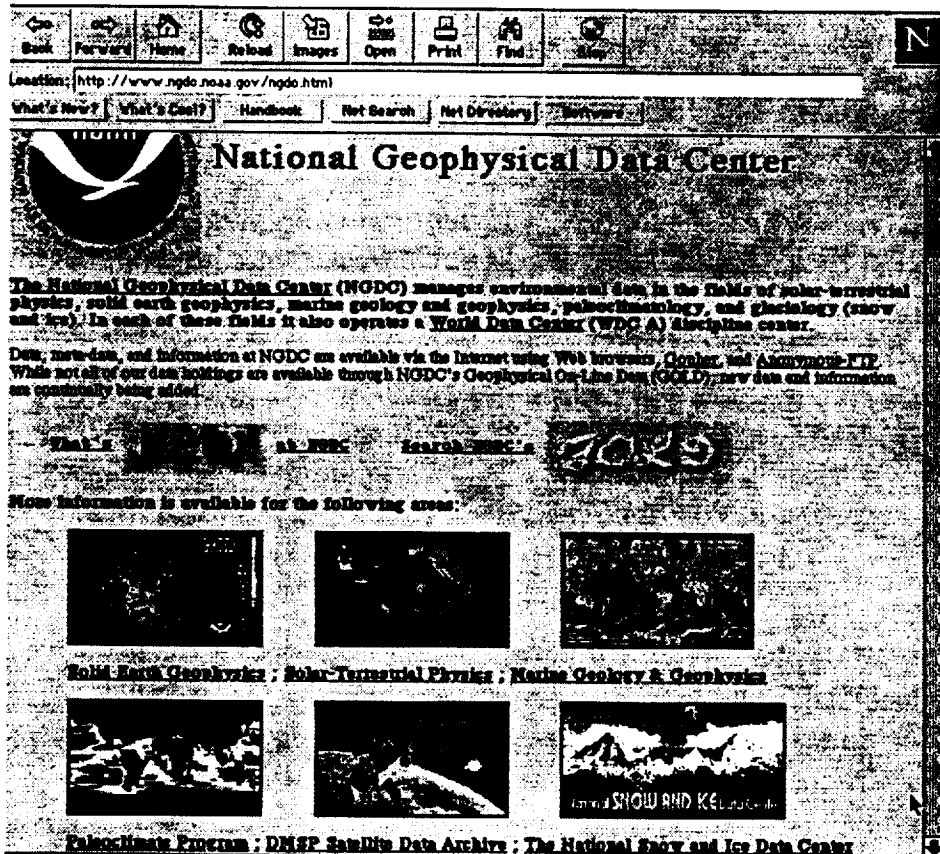
Breathtaking collection of soft x-ray images of the sun taken onboard the Yohkoh spacecraft.

<http://www.space.lockheed.com/SXT/homepage.html>

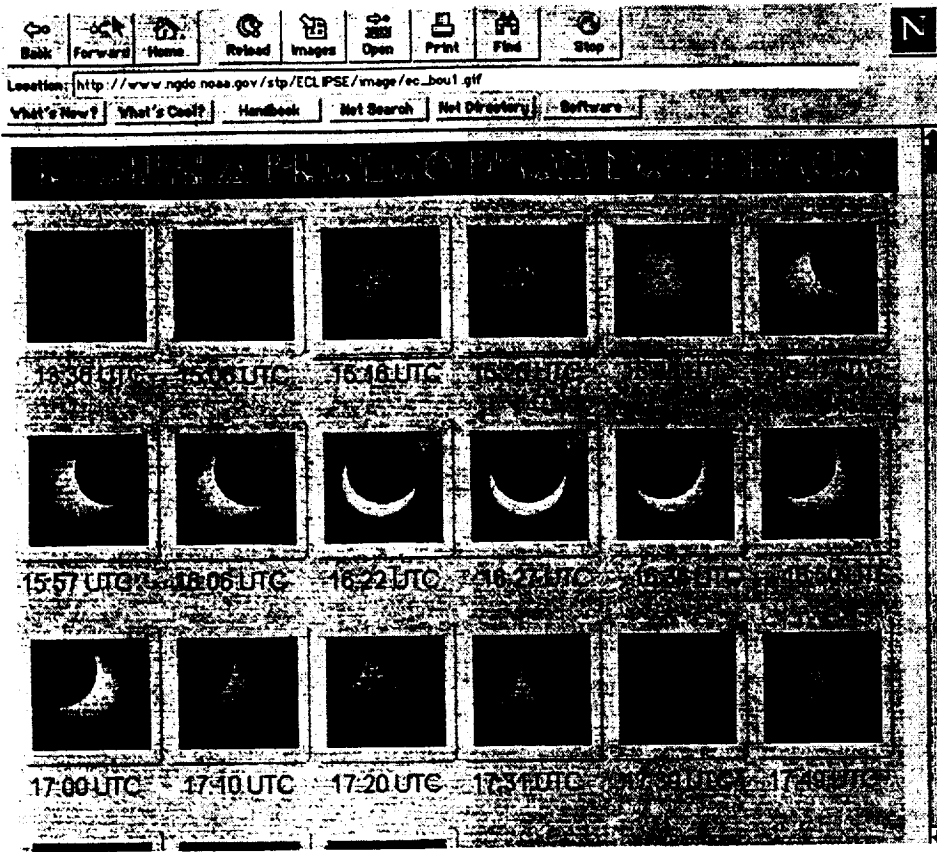


Space weather data resources at NOAA

<http://www.esdim.noaa.gov/#data-products>



<http://www.ngdc.noaa.gov/ngdc.html>



Beautiful solar
eclipse sequence
from the NOAA
archives

http://www.ngdc.noaa.gov/stp/ECLIPSE/image/ec_bou1.gif

Hot Links to Other Space Weather and Space Physics Sites

It's not possible to include specific information on every space physics related site -- this pocket guide would turn into an immense volume. There are fortunately lists of Hot Links scattered throughout the web that will lead you around the world and back as you browse. We include some of the more complete lists that we have run across in our travels. Bon Voyage!

Netscape: Space Physics WWW Reference

Location: <http://www oulu.fi/~spaceweb/reference.html>

What's New? What's Cool? Handbook Net Search Net Directory Software

Space Physics WWW Reference

Space Physics WWW Reference - last update: February 23, 1996, 14:01 UT (04h)

Table of Contents (Space Research by Topic)

- [Conferences](#)
- [Data Sources](#)
- [Education and on-line Text Books](#)
- [Forecasts](#)
- [Ground-based Instruments](#)
- [Phenomena](#)
- [Pictures](#)
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- [Satellites](#)
- [Software Projects](#)
- [Sounding Rockets](#)
- [Space Calendar](#)
- [Space Physics Acronyms](#)
- [Space Research Institutions \(now on extra page!\)](#)
- [Summer Schools](#)
- [Who's Who in Space Physics \(AGU/SPA service\)](#)
- [Workshops](#)
- [WWW Resource Lists](#)
- [Resource Lists by Simon Walker \(this will be incorporated here in due time!\)](#)

Data Sources

Real Time Data

Data Centers in the U.S.A.

- [Environmental Research Laboratories](#)
- [Los Alamos National Laboratory \(LANL\) CIRA/NOAA data](#)
- [National Center for Atmospheric Research \(NCAR\)](#)
- [National Geophysical Data Center \(NGDC\)](#)
 - [Solar Terrestrial Physics Section \(STP\)](#)
- [National Snow and Ice Data Center \(NSIDC\)](#)
 - [NSIDC DAAC Catalog](#)
 - [Data Access and Announcements](#)
- [National Space Science Data Center \(NSSDC\)](#)
 - [COHWeb System](#)
 - [Solar Physics](#)
 - [SPeCAT \(Space Physics Catalog\)](#)
 - [Space Physics](#)
 - [Space Physics Catalog, SPeCAT](#)
 - [OMNIWeb](#)
 - [Data Request Form](#)
- [NASA](#)
 - [Space Physics Data System of NASA \(SPDS\)](#)
 - [SPDS-Magnetospheric On-Line Data System, Navigator \(SPDS-MOLD\)](#)
 - [Ionosphere/Thermosphere/Magnetosphere Space Physics Data System \(SPDS-ITM\)](#)
- [Real-time Data Display and Analysis System \(RDDAS\)](#)
- [Space Physics Data Center UCLA \(UCLA/SPDC\)](#)

World Data Centers (WDC)

- [WDC C1 for Solar-Terrestrial Physics, U.K.](#)
- [WDC C2 for Ionosphere, Japan](#)
- [WDC Belgium, FTP](#)

Other Data Sources

<http://www oulu.fi/~spaceweb/reference.html>

Education

- **International Space Physics Educational Consortium (ISPPEC)**
 - **Finland**
 - Finnish Language Center
- **Universities**
 - Helsinki University of Technology, Helsinki, Finland
 - University of Jyväskylä, Jyväskylä, Finland
 - NASA E-12 Research Initiative With Host
 - U.S. Space Science Center, Boulder, CO
 - Swedish Institute of Space Research, Stockholm, Sweden
 - Space Research Center, Kiruna, Sweden
 - University of Oulu, Oulu, Finland
 - University Courses on Svalbard, UNIS, Norway
- **Research Schools**
 - **Workshops**
 - WWW-based text books (and lectures)
 - Plasma text book by the Northern Lights Planetarium, Tromsø, Norway
 - Plasma of Space Flight text book by JPL, USA
 - Plasma Physics course, IIRF, U. Sweden
 - The Evolution of the Earth's Magnetosphere
 - Magnetospheric Data and Educational Material, IPS, Australia
 - The Nine Planets, Multimedia Tour of the Solar System, by Bill Arnett
 - NRL Plasma Fundamentals
 - WWW-based Postscript Version from Finland (compressed, 212kB), Germany (513kB), USA (513kB)
 - WWW WWW Version, Germany
 - The Magnetosphere, C. T. Russell
 - The Magnetosphere, James L. Green
 - Plasma Waves Associated with the Bow Shock of Jupiter, W. S. Kurth
 - Planetary Magnetospheres, C. T. Russell
 - Space Physics text book, Space Physics Group, Oulu, Finland
 - Space Physics Tutorial of the San Diego Space Physics Group, USA
 - The Space Shuttle Clickable Map, SSA Inc.
 - Space Weather, Rice University, USA
 - Visualization of Space Plasma Processes by the UCLA Space Physics Group
 - Waves in Space Plasmas, W. S. Kurth
 - Welcome to the Planets, by NASA
- **Other related material:**

Ground-based instruments

- **Ionosondes**
 - **Dissonda** at Tromsø, Norway
 - Ionospheric Station of the Sodankylä Geophysical Observatory
 - Swedish Ionosonde System (SIN)
- **Ionospheric Heating Facilities**
 - EISCAT Heating Facility, Tromsø, Norway
 - SURA Heating Facility of NIIIFI, Nizhny Novgorod, Russia
- **Magnetometers**
 - IMAGE
 - Finland magnetometer chain of University of Oulu
 - Sodankylä Magnetometer Station of the Sodankylä Geophysical Observatory
 - Nurmajärvi Magnetic Station of the Finnish Meteorological Institute
 - Geomagnetic data from the Aarnav Observatory, Tromsø, Norway
- **Optical Instruments**
 - Auroral Laser Imaging System (ALIS)
 - All Sky Camera chain of the Finnish Meteorological Institute
 - TV Camera and Photometer of the University of Oulu, Finland
- **Radiars**
 - COSCAT
 - CUTDARS
 - EISCAT
 - ESRON
 - STARE
 - SUNDARN
- **Riometers**
 - Ionospheric Station of the Sodankylä Geophysical Observatory, Finland
- **VLF Receivers**
 - Instrumentation
 - Measurements in Finland

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<http://www.oulu.fi/~spaceweb/reference.html>

Phenomena

Auroral Sounds

- o **Auroral Sounds: A Real Phenomenon**
by Colin Kemp, University of Newcastle, Australia
- o **Sounds of the Aurora**
by IRI, Umeå, Sweden
- o **Sprites**
o **Red Sprites and Blue Jets**, University of Alaska, Fairbanks, USA
- o **High altitude electromagnetic fields (HEMFs and jets)**, University of Oulu, Finland

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Pictures

Warning: These pages do contain pictures. You might want to disable automatic loading of pictures in your WWW browser to speed up the connection.

- o **Aurora from Earth**
o **Aurora from Earth** by Michael T. Dolan
- o **Field magnetograms in Northern Finland** by Jyrki Manninen
- o **Aurora from Space**
o **Reactive Images**
o **Reactive and Space Shuttle Images**
- o **Sun**
o **Images of the Sun**

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Real Time Data and Forecasts

Other Data Sources

- o **Forecasts**
o **Current Solar Forecast**, Space Environment Lab, USA
- o **Prediction Services**, IPS, Australia
- o **Spacecraft Bulletin**, NESDC / WDC-A, USA
- o **Index of Space Weather**, Space Environment Lab, USA
- o **Real Time Data**
o **Ionospheric Data**
o **Kilua**, Sweden
- o **Edmonkyl**, Finland, (F-Plot)
- o **Trondheim**, Norway
- o **Uppsala**, Sweden
- o **Magnetic Data**
o **Kakioka**, Japan
- o **Kilua**, Sweden
- o **Edmonkyl**, Finland
- o **Trondheim**, Norway
- o **Uppsala**, Norway
- o **Photometer**
o **ALIS Outlook Images**
- o **Meridian Scanning Photometer**, Svalbard, Norway
- o **Radar**
o **CHILASS / Finland**
- o **Riometer**
o **Finland Network**
- o **Solar Data**
o **Current Solar Images (20-130 kbytes)**, SRI
- o **Solar Images at SDAC**
- o **Solar wind data from NASA's WIND satellite**
- o **Summaries**
o **Current Australian Region Solar Thermal Environment** by IPS Regional Warning Centre

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<http://www oulu.fi/~spaceweb/reference.html>

Metastep: Directory of SPA WWW Sites

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Location: <http://lepsam.gsfc.nasa.gov/www/sampex.html>

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Directory of SPA WWW Sites

[Organizations](#)
[Agencies](#)
[Data Centers/Databases](#)
[Projects](#)
[Research Groups](#)
[Public Outreach/Education](#)
[Journals/Books/Newsletters/Alerts](#)
[History/Conferences/Public Affairs](#)

Note: If you have a home page to be added to this directory, please send the URL to us.

ORGANIZATIONS

- American Geophysical Union (AGU)
- American Association for the Advancement of Science (AAAS)
- American Astronomical Society (AAS)
 - AAS Job Register
- American Institute of Physics (AIP)
 - AIP Physics Careers Bulletin Board
- American Physical Society (APS)
- The Association of American Universities (AAU)
- Canadian Astronomical Society (CASA)
- Committee on Space Research (COSPAR)
- European Geophysical Society (EGS)
- International Astronomical Union (IAU)
- National Academy of Sciences/National Academy of Engineering/National Research Council (NRC)
 - NRC Space Studies Board
- The OURE Foundation

[http://lepsam.gsfc.nasa.gov
/www/sampex.html](http://lepsam.gsfc.nasa.gov/www/sampex.html)

Netscape: Space Science Education: NASA Missions

Location: http://www.gsfc.nasa.gov/education/nasa_missions.html

What's New? What's Cool? Handbook Net Search Net Directory Software

Selected NASA Missions for Space Science Education

Astrophysics

- ☐ [Cosmic Background Explorer \(COBE\)](#)
Cosmology, a branch of astrophysics, is aimed at understanding how the universe came into existence and developed into its current state. The three instruments on NASA's Cosmic Background Explorer (COBE) satellite succeeded in answering some of the most basic cosmological questions.
- ☐ [Compton Gamma Ray Observatory \(CGRO\)](#)
- ☐ [Hubble Space Telescope \(HST\)](#)
- ☐ [International Ultraviolet Explorer \(IUE\)](#)

Planetary Science

- ☐ [Galileo Mission to Jupiter](#)
- ☐ [Clementine Moon Observation Project](#)
- ☐ [Marsden Mission to Venus](#)
- ☐ [Apollo Missions to the Moon](#)

Space Physics

- ☐ [Yohkoh Missions to the Outer Solar System](#)
- ☐ [ISEE Missions for Solar Wind Study](#)
- ☐ [WIND Mission for Solar Wind Study](#)
- ☐ [Ulysses International Mission for High Latitude Solar Wind Study](#)
- ☐ [POLAR Mission for Solar Wind Study at Earth's Auroras](#)

Solar Physics

- ☐ [SOHO Missions to the Sun](#)
- ☐ [Yohkoh Mission for Solar Flare Observation](#)

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Contact Person: [Nathan L. Janes](#)
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 Greenbelt, MD 20771

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A detailed look at a number of important NASA missions with Hot Links to other sources of information on the web.

http://www.gsfc.nasa.gov/education/nasa_missions.html



Location: http://ranier.oact.hq.nasa.gov/Sensors_page/MissionLinks.html

What's New? What's Cool? Handbook Net Search Net Directory Software

Space Mission Acronym List and Hyperlink Guide

Here are links to information on a variety of space missions and instruments. This page, like NASA, is under continuous improvement and subject to change and restructuring at a moment's notice. This is by no means a complete list of space missions, and represents the bias towards robotic science missions imposed by my job assignment. With the exception of some NASA technology demonstration missions (such as ACTS), I have not included communications satellites (see also the [NASA Experimental Communications Satellite](#) page from the Space Electronics Division at LeRC). In addition, I have not attempted to keep the information about payloads on the Space Shuttle complete or up to date. Excellent information is available through the initial sources listed under Space Shuttle. In some cases two different uniform resource locators (URLs) appear to point to the same information. In these cases I have left the multiple paths, in case one is being phased out or is not working. I don't have the time or tools to scan regularly for dead links, and mission plans change almost as fast as the web. Please send any dead links, corrections, or suggested additions to [Gordon Johnston](#).

SPACE MISSIONS

ACE -- Advanced Composition Explorer

- [Advanced Composition Explorer \(ACE\) from the Explorer Project Office at GSFC](#)
- [Advanced Composition Explorer \(ACE\) from the Space Radiation Laboratory at Caltech](#)
- [ACE FACT SHEET](#) from the JHU/APL Space Department
- [NASA Astrophysics Mission Launch Page](#) and [NASA Astrophysics Missions](#) (mostly in Word format) from the Astrophysics Division at NASA Headquarters

ACTS -- Advanced Communication Technology Satellite

The Advanced Communications Technology Satellite was launched from the Kennedy Space Center, Pad 39B, aboard the Space Shuttle Discovery (OV-103) as part of the STS-51 mission on September 12th, 1993. On the same day, ACTS was deployed from the shuttle bay. ACTS, a primary payload on the mission, was placed in a geostationary orbit at 100 degrees west longitude.

- [Advanced Communication Technology Satellite Home Page](#)
- [The Advanced Communications Technology Satellite \(ACTS\) Mobile Terminal](#) is a proof-of-concept bread board designed to meet the challenges of Ka-band land mobile communications.
- [The Advanced Communications Technology Satellite \(ACTS\) Propagation Program](#) supports the development of new satellite communication services by conducting short path radio wave propagation experiments and studies for fixed, mobile and broadcast applications.

ADEOS -- Advanced Earth Observing System

Japan plans to launch the polar-orbiting ADEOS mission in February 1996. The NASA SeaWiFS (NSCAT) instrument on this mission is supported as an Earth Probe. This mission is part of the DEOS. For a general description, see the [Mission Elements](#) section of the [Reference Handbook for EOS](#).

- [JPL Press Release: NEW INSTRUMENT TO MEASURE OCEAN WINDS INTEGRATED THIS WEEK](#) (dated April 7, 1995)

http://ranier.oact.hq.nasa.gov/Sensors_page/MissionLinks.html

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AGENDA

"What is Space Weather" A workshop for science writers February 23, 1996

- 8 a.m. - Registration, continental breakfast buffet
Room 2238, U-M Space Physics Research Bldg.
- 8:30-11:15 a.m. Morning session
Room 2238, U-M Space Physics Research Bldg.
- Welcome and Announcements: C. Robert Clauer
- "What is Space Weather and Why are we Interested: An Introduction"
Daniel N. Baker
Director, Laboratory for Atmospheric and
Space Physics, University of Colorado-Boulder
- "Space Weather Forecasting: Who Cares?"
Howard Singer
Chief of Geospace Branch, NOAA Space Environment
Center in Boulder, Colorado
- "Geomagnetic Storms and Threats to Electric Power Systems"
John Kappenman
Head of Transmission Planning Department
Minnesota Power
- Informal discussion and question-and-answer period.
- 11:30-12:30 p.m. Buffet lunch for all journalists and scientists with continuing
discussion.
2238 Space Physics Research Bldg.
- 12:45 - 2:30 p.m. Afternoon session
Room 2238, U-M Space Physics Research Bldg.
- "Nowcasting to Forecasting: Getting Today's Space Weather
Today"
Patricia H. Reiff
Professor of Space Physics and Astronomy
Rice University
- "Mining Information Related to Space Weather Using the World
Wide Web"
Janet U. Kozyra
Associate Research Scientist
U-M Space Physics Research Laboratory

"Satellites, Research and Space Weather"

**Mario Acuna
Goddard Senior Fellow, NASA Goddard Space Flight
Center**

"So What if there is a Little Spot on the Sun"

**Joe Gurman
Facility Scientist for the Solar Data Analysis Facility, NASA
Goddard Space Flight Center**

General discussion and question-and-answer period.

3 p.m.

**Colloquium Lecture
Auditorium, Francois-Xavier Bagnoud Bldg.**

**"How Does the Dynamic Space Environment Affect Our
Technologies in Space and on the Ground."**

**Louis Lanzerotti
AT&T Bell Labs and University of Florida**

4:30 - 6 p.m.

**Laboratory research demonstration of The Upper Atmospheric
Research Collaboratory (UARC), featuring coordinated ionospheric
observations in Greenland, and data from the WIND satellite.
Room 2520 Space Physics Research Bldg.**

**C. Robert Clauer
Research Scientist
U-M Space Physics Research Laboratory**

6:30 - 8 p.m.

**Dinner at one of Ann Arbor's excellent restaurants for all scientists
and journalists who wish to attend.**

After 8 p.m.

**Continuing UARC supported experimental campaign operations
and opportunity for additional follow-on participation and
interviews by journalists.**

Committee on the Future of the U. S. Space Program, and membership on the Vice President's Space Policy Advisory Board. He has been elected to the National Academy of Engineering, and the International Academy of Astronautics and is a Fellow of the American Geophysical Union, the American Physical Society and the American Association for the Advancement of Science. He has published over 400 science and engineering papers and is co-author or co-editor of three books. Dr. Lanzerotti will present a colloquium lecture titled: "How Does the Dynamic Space Environment Affect our Technologies in Space and on the Ground"

Dr. Patricia H. Reiff received the Ph.D. from Rice University, Houston, and is now Professor of Space Physics and Astronomy there. She has been active for over 20 years in the area of solar wind-magnetosphere-ionosphere coupling. She is a Co-Investigator on the Magnetic Field Experiment on the POLAR spacecraft (to be launched January 1996), and a Co-Investigator on the PEACE electron spectrometer on the Cluster suite of spacecraft (to be launched April 1996). She is the liaison between real-time solar wind data from the WIND spacecraft and the real-time Magnetospheric Specification and Forecast Model at Rice. In addition, she is the PI of a public information program "Creating the Public Connection" which brings real-time Earth and Space data to schools in the form of interactive computerized displays (both as physical kiosks in the Houston Museum of Natural Science and as web-based information servers). This project, funded by NASA's Digital Library Technology Program, has brought space weather to over 100,000 museum visitors and over 100,000 web visitors last year. She will present "Nowcasting to Forecasting - Getting Today's Space Weather Today"

Dr. Raymond G. Roble received the Ph.D. from the University of Michigan and currently is a senior scientist at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. His research concentrates on the chemistry, physics, and dynamics of the upper atmosphere and on global atmospheric electricity. He has constructed a hierarchy of general circulation models of the coupled thermosphere-ionosphere-mesosphere system and his most recent model is called a thermosphere-ionosphere-mesosphere-electrodynamics general circulation model (TIME-GCM) that extends over the 30 to 500 km altitude range. These various general circulation models have been used to analyze data from the NASA Atmosphere Explorer, Dynamics Explorer, Solar Mesosphere Explorer, and Upper Atmosphere Research Satellite. He has served on numerous national and international committees and has authored and co-authored over 230 publications. He is a fellow of the American Geophysical Union.

Dr. Howard Singer received the Ph.D. from the University of California, Los Angeles and is presently the Chief of the Geospace Branch at the NOAA Space Environment Center in Boulder, Colorado. He is the responsible scientist for the Geostationary Operational Environmental Satellite (GOES) spacecraft magnetometers and the Lead Scientist for the GOES Space Environment Monitor instruments used for space weather operations, which includes monitoring and predictions. Prior to working for NOAA, Dr. Singer participated in the joint AF-NASA Combined Release and Radiation Effects satellite (CRRES) program used to examine the effects of space weather on spacecraft systems. Dr. Singer spent one year as a research scientist at South Pole Station, Antarctica, currently conducts research on geomagnetic disturbances that affect human activities in space and on the ground, has authored or co-authored over 70 publications and is a Co-investigator on the POLAR and CLUSTER satellite missions. He will present "Who Cares about Extra-terrestrial Weather?"

WORKSHOP PARTICIPANTS

"What is Space Weather?" A workshop for science writers February 23, 1996

Dr. Mario H. Acuna, Goddard Senior Fellow, NASA Goddard Space Flight Center. Dr. Acuna received the Ph.D. degree from The Catholic University of America in Washington, D.C. His interests have centered around experimental investigations of the magnetic fields and plasmas in the solar system. He is US Project Scientist for the International Solar Terrestrial Physics Program (ISTP), a joint international research effort by Japan, Europe and the US involving more than 1000 investigators and the launch of nine spacecraft in the early and middle 1990's. He has participated in numerous satellite experiments and missions, including the Explorers 47 and 50 missions, Mariner 10, Pioneer 11, Voyagers 1 and 2, MAGSAT, Project Firewheel (Germany, Canada, USA & UK), Viking (Sweden), The Active Magnetospheric Particle Tracer Explorers (AMPTE), (Germany, US, UK), the International Solar Polar Mission (currently ULYSSES), the GIOTTO mission (ESA) to comet Halley. He is the Principal Investigator for the Mars Observer Magnetic Field Investigation, launched in 1992 and to be followed by Mars Global Surveyor in 1996. Dr. Acuna has published over 70 refereed scientific papers and has been honored with several distinguished awards. In 1985 he was selected by the IEEE Magnetism Society as one of three Distinguished Lecturers to speak on the subject of Space Magnetometry.

Dr. Daniel N. Baker received his PhD from the University of Iowa and is currently Director of the Laboratory for Atmospheric and Space Physics at the University of Colorado at Boulder and a Professor in the University of Colorado's Department of Atmospheric, Planetary and Astrophysical Sciences Department. Dr. Baker has devoted much of his recent research effort to understanding magnetospheric substorms. He has shown how these disturbances contribute to anomalies in the operation of near-earth spacecraft and has developed nonlinear (chaos) models of substorm processes. He is the author or co-author of approximately 280 scientific papers in refereed journals in the area of space research and he presently serves on several NASA advisory committees. Dr. Baker is a member of AAAS, Sigma Xi, International Academy of Astronautics, and is a Fellow of the American Geophysical Union. He will present "What is Space Weather and Why are we Interested: An Introduction"

Dr. C. Robert Clauer received the Ph.D. from the University of California, Los Angeles and is a Research Scientist and Adjunct Professor of Atmospheric, Oceanic and Space Physics at the University of Michigan. He is a principal investigator on several projects which utilize ground based instrumentation in the arctic and Antarctic in coordination with satellite measurements to investigate the coupling of energy between the solar wind and the Earth's magnetic field and ionosphere. He is also a Co-Investigator on the POLAR Satellite mission. He is an Associate Editor of the Journal of Geophysical Research -- Space Physics and is an author on over 60 research publications.

Dr. Joe Gurman received the Ph.D. from the University of Colorado, and is the Facility Scientist for the Solar Data Analysis Center at Goddard Space Flight Center in Greenbelt, Maryland. He was the Solar Maximum Mission (SMM) Project Scientist from 1986 to 1989, and the Instrument Manager for the Ultraviolet Spectrometer and Polarimeter (UVSP) on SMM from 1985-1989. He is currently a Co-Investigator on the Extreme ultraviolet Imaging Telescope (EIT) on the SOHO satellite. His research concentrates on sunspots and the sun's outer atmosphere. He will present "So what if there is a Little Spot on the Sun."

Mr. John Kappenman received the Electrical Engineering degree from South Dakota State University and is presently Head of the Transmission Planning Department at Minnesota Power. He is undertaking research on magnetic storms and their disruptive effects on electrical power systems and is leading a design team to develop mitigation techniques. He is a senior member of the Institute of Electrical and Electronics Engineers and the Power Engineering Society and is the chair of the Transmission and Distribution Committee. He is Chair of the Industry Advisory Board for the University of Minnesota - Duluth Electrical and Computer Engineering Department. He holds a US Patent for his invention of a Static Phase Shifting Transformer. He has over 30 publications on the subjects of geomagnetic disturbances, power electronics, and the analysis of lightning impacts on electric power systems.

Dr. Timothy L. Killeen received his Ph. D. from the University College, London and is presently Professor of Atmospheric and Space Sciences at the The University of Michigan. Major area of interests in physics and chemistry of the Earth's Upper Atmosphere. He is the Director of the Space Physics Research Laboratory, The University of Michigan, and is an associate editor for the Journal of Atmospheric and Terrestrial Physics. Dr. Killeen has authored and co-authored over 120 publications in refereed journals.

Dr. Janet U. Kozyra received her PhD from the University of Michigan and is currently an Associate Research Scientist at U of M's Space Physics Research Laboratory within the Department of Atmospheric, Oceanic and Space Sciences. She has participated in a number of NASA science missions, first as an Interdisciplinary Scientist on the Dynamics Explorer satellite team, as a guest investigator on the Anomalous Magnetospheric Particle Tracer Experiment/ Charge Composition Explorer (AMPTE/CCE) science team and as been recently selected as an interdisciplinary scientist for the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) spacecraft mission which is currently in the development phase. She is actively involved in developing content for a earth and space sciences information site on the world wide web called "Windows to the Universe" which provides a linkage to NASA's space databases and is supported by NASA's Office of High Performance Communications and Computing. She is an associate editor of Geophysical Research Letters and a member of the National Academy's Committee on Solar and Space Physics (CSSP). She was a recipient of the 1992 University of Michigan Outstanding Research Scientist Award. She will present "Mining Information Related to Space Weather Using the World Wide Web"

Dr. Louis Lanzerotti received the Ph.D. degree from Harvard and is a Distinguished Member of Technical Staff at AT&T Bell Laboratories, and Adjunct Professor of Electrical Engineering at the University of Florida. He has also served as Regents' Lecturer at UCLA. His principal research interests include space plasmas, geophysics, and engineering problems related to the impact of space processes on space and terrestrial technologies. He has participated on or chaired numerous national and international science and science policy committees, including two terms as chairman of the Space Studies Board of the National Research Council, a member of the 1990 Vice-Presidential Advisory